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THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

February Meeting, Society of Gas Lighting.

OFFICE OF THE SECRERARY, January 25, 1894.

The February meeting of the Society will be held at Hotel Washington, Jersey City, N. J., on Thursday, February 8, at 3 o'clock, P.M.

F. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

Twenty-Fourth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 18, 1894.

The twenty-fourth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d. The meeting will be called to order at 10 o'clock, Wednesday morning.

A general invitation is extended to members to contribute to the interest of the meeting by papers or questions for the Question Box.

A list of the papers and questions to be considered will be published later.

C. F. PRICHARD, Secretary.

BRIEFLY TOLD.

SIGNS OF BETTER DAYS.—The silver lining seems to show on the edges of the clouds which have hung heavily for some months on the gas maker's horizon, for we are in receipt of reports from several points which all tell the same gratifying story of an increase in business and a decided brightening of the outlook. This opinion applies more particularly to the larger centers, but it is none the less reassuring on that account, for increased activity at the middle must eventually result in a quickening of the extremities. The increase, too, grows more marked as the days go by, which fact must be accepted as proof that the revival is not to be taken as a spasmodic one, but rather as a movement the progress of which is to be continuous. One Company reporting, which supplies a city of something under 25,000 inhabitants, makes the comment that the apparent increase in its output, which increase is estimated from the station meter records rather than from the indexes of the consumers' meters, for the first 15 days of January, as against the last 15 days of December, amounts to 11 per cent. And the gain is all the more significant when it is known that the manufacturing concerns in the city—that is, so far as factories and workshops are concerned—are in about the same state of half operation in which they had been for the past three months. One most remarkable thing in connection with the shrinkage in the gas sendout during the present depression is that the greatest portion of the total shrinkage could be fairly charged to economies in the household consumption of gas, and this unhappy state of affairs well illustrates how far reaching have been the effects of the paralyzation of trade in general. It is true, the exceptionally mild winter season so far experienced, in the East particularly, is responsible for a good share of gas losses, in that the use of gas fuel for the temporary warming of bathrooms and other like purposes, has been checked, but

those who have watched the matter closely in their respective localities, are practically agreed that the small savings in the use of gas in the kitchen, parlor, dining and lounging rooms, have been steadily pursued. The artistic or garish oil lamp, as the case may be, has been in evidence with great frequency, and where such were formerly used for "effect" only, they now are used for "work." At any rate, the turning point is undoubtedly reached, and none too soon. However, if the gas men have had reason for complaint, the suppliers of electric currents have almost had cause for despair, and in no other city of the country has this been more clearly perceptible than in New York. The frugal householder or shopkeeper who turned from the use of gas to oil has been almost, if not fully replaced to the Gas Companies by the frugal householder or shopkeeper who turned from incandescent electric lamps to gas, wherefore a clear loss has been the portion of the electrician. Then, too, we have had many examples of the actual bankruptcy of electric companies in the past four months, whereas in the same period we have record of only three Gas Companies which were forced to the wall; and of these, two were burdened with electric lighting annexes. Taking the situation, large and small, the gas makers are to be congratulated anent the facility with which they tided over the bad times.

THE OHIO PLAN FOR DISPOSING OF COAL TAR.—Elsewhere we print the report in full of the Tar Committee of the Ohio Gas Light Association, which Committee evidently was not satisfied, as so many of the Association committees have unfortunately been in the past—to come together shortly before the date set for the next meeting of the body which appointed them and report progress, or something equally indefinite or intangible. Of course we have in mind the fact that the members of the Committee were not separated by the magnificent distances which often act so potently in nullifying the good results that might attend, for instance the appointment of a committee for a similar purpose by the American Association; but in any event, whether it was propinquity or extra zeal which is responsible for the action of the Ohio Committee, we can accept their findings with satisfaction. Plan "A" presents no impracticable project; on the contrary, it is easily understandable, and not the least of its merits is that it involves no great expenditure of money. Neither does it require the passage of any important length of time before it can be put in practical application. It is unfortunate, perhaps, that at the outset, even if all the remaining companies in Ohio enter into the agreement, only one-third of the entire coal tar output of the State can be handled, for it is admitted that Cincinnati and Cleveland, the combined output of which is put at 50,000 barrels, "have stills at their doors, and their tar is now under contract for a term of years," yet the remaining one-third (or 25,000 barrels) is quite a comfortable nucleus or starting volume; and it is also possible that many of the important points in near-by States might eventually wish to add their quota of tar for the general good—of themselves. Whether or not the gas makers of Ohio in general agree to take part in this movement, all of us will have the satisfaction of knowing that the tar product of Columbus will be worked up by the Columbus Gas Company for its own account, and that will be so much less of profit for the tar ring which so skilfully turned the wool over the sharp protective eyes of the Hon. Mr. McKinley, when he was framing the tariff measure that brought him about equal volumes of fame and abuse. The Committee's work is worthy of all praise, and they may be sure they will have at least the moral support of every gas maker in the States who is a producer of tar, and who is not interested in the manipulation of that product other than to obtain for his company the very best possible price that he can for it.

NOTES.—Mr. Austin C. Wood, Vice President and Superintendent of the Gas Light Company, of Syracuse, N. Y., sailed for the Bermudas, per Steamship Trinidad, which left New York on Wednesday last. He was accompanied by his daughter. He visits the Islands for recreation and recuperation, his health having been somewhat impaired by a severe attack of the grip.——The proprietors of the Port Huron (Mich.) Gas Light Company have awarded a contract to the Western Gas Construction Company for the placing of a set of 5 foot apparatus of the Construction Company's improved Lowe type. The contract is to be completed as speedily as possible.——Mr. Vinton W. Mason has been elected to the Board of Directors of the Malden and Melrose (Mass.) Gas Company.——Dollar gas in Philadelphia is an accomplished fact, the meters in service having been inspected, and all accounts on the $1.50 basis have been charged up.——At the annual meeting of the Brattleboro (Vt.) Gas Light Company, the Treasurer's report showed that the Company's capital stock had been increased from $30,000 to $60,000, the major portion of which increase was spent in fitting up an electric annex. The regular semi-annual dividend of 3 per cent. was declared, and the following officers were elected: Directors, H. D. Holton, O. D. Esterbrook, S. N. Herrick, J. L. Martin and G. C. Averill; President, H. D. Holton; Clerk and Treasurer, C. F. Thompson.

[Prepared for the JOURNAL.]

Valuation of "Oxide."

By DURAND WOODMAN, Ph.D.

In the JOURNAL of Jan. 16, 1893, p. 81, I find reference to a method of ascertaining the percentage of ferric oxide present in any sample of purifier oxide, quoted from "King's Treatise."

Referring to the Treatise, Vol. II., p. 26, the directions are found to be as below given, abreviating as much as possible:

"The actual valuation of any sample may be effected as follows: Dry, at 160° F. Take 100 grains and ignite at moderate red heat in platinum crucible, stirring occasionally to destroy organic matter. Digest residue in a flask with strong hydrochloric acid, a small quantity of nitric acid being finally added, until residue has lost its red or brown color. Dilute the acid solution with water; filter; wash the insoluble residue and add ammonia in slight excess to the clear filtrate, precipitating ferric hydrate and any alumina which may be present.

"Transfer precipitate to a filter, wash thoroughly with hot water, and dissolve by pouring on it moderately strong hydrochloric acid.

"Wash the filter and treat the solution so obtained with an excess of caustic potash solution, which precipitates the ferric oxide but holds alumina in solution; then collect the precipitate on a filter, wash thoroughly, dry, and weigh. The weight so obtained represents the amount of ferric oxide present in the sample under examination."

If it had been specified that this process was applicable *only to native bog ore oxides, or to oxides free from admixture with metallic iron*, instead of *to any sample*, it would have been well; for as it now stands it is a trap to mislead the amateur chemist, and, as a rule, the practical gas man has not time to be other than an amateur, and has enough to do to follow the directions in a method given by good authority without undertaking to revise the method.

If this scheme is followed in analyzing an artificial oxide which has been made up partly from iron drillings, borings or turnings, the result will be altogether incorrect; for no matter how careful or thorough the preparation, a large percentage of metallic iron remains as such, coated with a variable thickness of rust (hydrated sesquioxide), which protects it from further oxidation except slowly.

On treating with hydrochloric acid the iron goes into solution, appearing in the result as oxide, and in the proportion of 10 parts to 7 of metallic iron.

The iron in such oxides is usually well disguised by the coating of rust above mentioned, and one might easily be led to apply the foregoing method without suspecting any reason for obtaining an absurdly fallacious result. I have before me a sample of prepared oxide which has the following approximate composition:

Metallic iron	40.0
Ferric oxide (Fe_2O_3)	13.0
Lime	3.0
Silica	1.5
Wood chips (by difference)	42.5
	100.0

The iron is well rusted superficially, and very little of it is large enough to attract attention.

It would yield 71.8 per cent. of ferric oxide if treated as King directs. A complete analysis, of course, would indicate that something was wrong by footing up considerably above 100 per cent.; but ordinarily this would not be done, for "the purifying value of any particular sample depends obviously on the amount of hydrated ferric oxide present; and a chemical examination can be confined to this particular point, *neglecting all other constituents.*" ("King's," Vol. II., p. 26.)

The first step in making an analysis is to obtain a correct average sample. This may seem a very simple thing, but some of the pitfalls are as follows:

If the heap should be dry, it will be found that the oxide and metallic iron have a marked tendency to separate and work downward from the wood chips, so that the upper part will give on analysis a lower figure than the truth, while the contrary will result from an analysis of the under layers. Again, suppose the heap to be sufficiently damp to prevent mechanical separation, and a suitable sample is taken from it, dried, and put into a bottle or tube for weighing. The same trouble then appears again on a smaller scale, and as the bottle or tube is turned and jarred to get the desired amount on the scale pan, mechanical separation takes place, and that portion remaining in the tube is found to have less wood and more oxide than that which has been turned out.

It is, therefore, absolutely necessary to give careful attention to the sampling, in order to avoid introducing a considerable error before the work is really begun.

After drying, the sample should be tested for metallic iron by a magnet; if found to be present, the analysis assumes a much more complicated form than that applicable to a "straight" oxide, and one of the methods given in the text books on quantitative analysis for determination of metallic iron in presence of its oxides must be employed.

The writer hopes soon to be able to describe a modification of one of these methods, which shall be reasonably simple and accurate, and not involve too great an expenditure of time.

Preliminary Report of the Tar Committee of the Ohio Gas Light Association.

At the last annual meeting of the Ohio Gas Light Association a Committee was appointed to consider the best available means of securing for the Gas Companies of Ohio the maximum return for the coal tar produced on these works. After many conferences the Committee has submitted the following preliminary reports, which are self explanatory:

COLUMBUS, OHIO, Dec. 29, 1893.

.....

.....

Gentlemen:—The work inaugurated by the Ohio Gas Light Association at its meeting last March, with the view of establishing a co-operative coal tar distillery, has been carried on by the Committee then appointed, which Committee, after much canvassing of the subject, has devised the plan marked "A" which accompanies this letter.

Also inclosed herewith is a document marked "B," which the Committee desires to submit in this connection.

A communication on this subject was sent you some time ago, and while replies were not received from all of those addressed, enough indorsed the purpose and rough plan of operation then suggested by the Committee to insure the establishing of a co operative company for the distillation of crude tar. We now transmit to you herewith the plan "A" of the organization and operation of this proposed company in sufficient detail to enable you to determine whether you desire to become a member of it.

After each Gas Company desiring to do so has indorsed the plan and agreed to furnish a person who will represent its indirect interest in the proposed co-operative distillery, subscription books will be sent for his subscription based upon his proposed annual pro rata contribution of tar.

The Committee offers the information that the Columbus Gas Company, immediately upon the assurance that this Committee has ceased its efforts in behalf of better prices for Ohio tar, will build a still of its own of sufficient capacity to take care of its own production of tar. The only reason why the Columbus Company loses any time at all in doing this is its consideration for the effort at co-operation that has been inaugurated by the Ohio Gas Light Association; knowing that, inasmuch as the Cleveland and Cincinnati Gas Companies have their tar sold for a term of years, this effort at co operation will hardly be feasible without the aid of the Columbus Company. It is therefore ready to co-operate now, but cannot defer, for any great length of time, the erection of its own distillery.

The distillation of coal tar is a simple and easy matter, and experienced men have already been secured to build and operate a plant and sell the products of the distillation. The operation of a tar still by the St. Joseph (Mo.) Gas Company is a complete success, and there is no reason why we should anticipate failure or loss. The Milwaukee Gas Company is now preparing to erect a tar distillery for its own use.

The Committee cannot undertake to estimate the increased revenue from your tar that would result from your co operation in the proposed plan; but with our raw material guaranteed, and a good finished product, we can certainly do as well as other distillers. There is nothing to lose, everything to gain.

Tar is now kept at a price at which it can be profitably burned under the retorts, and the "squeeze" is getting tighter. There is no prospect of an immediate rise, but our distillery property would be just as valuable with the tar market high as when it is low.

There are 75,000 barrels of coal tar produced in Ohio annually. Cincinnati and Cleveland represent 50,000 barrels, have stills at their doors, and their tar is now under contract for a term of years. The proposed distillery for the reduction of the balance (say 24,000 barrels) can be put in operation for $12,000, including storage tanks and tank cars for cheap transportation. Upon rough calculation of the tar make of each Company, a subscription by each Company of 50 cents per barrel of tar made in 1893 will furnish this amount. If less than all subscribe, the size and cost of the plant will be reduced accordingly.

Please sign the accompanying plan "A," if approved by you, and after all have had an opportunity to approve of the plan, incorporation papers will be taken out and the organization of a company proceeded with.

Very truly yours,

IRVIN BUTTERWORTH,
J. W. R. CLINE,
JEROME PENN,
CHAS. H. WELCH,
} Committee.

Plan "A."

Joint Stock Company, Incorporated under Laws of Ohio.

All Gas Companies in Ohio producing coal tar are invited and urged to participate.

Each Gas Company agreeing to participate to subscribe, through some trustee or personal representative (who must be financially good for the amount) to the capital stock of a company to be organized with an authorized capital of $24,000. Subscriptions to be binding when $6,000 shall have been subscribed. There shall be 48,000 shares of par value of 50 cents per share.

Each Gas Company to subscribe (through a trustee, as above set forth) one share of stock for each barrel (50 gallons) of pure coal tar produced by it in 1893.

Each subscriber or shareholder will be required to furnish each year to the distilling company, before the end of the fiscal year, not less than one barrel of pure coal tar for every share represented or owned by him in said year; failing in which, the directory of the distilling company will be authorized to purchase in the open market a quantity of tar equal to such shortage, and charge the cost thereof to such delinquent shareholder (in order that no shareholder may receive dividends in excess of a pro rata proportion of tar furnished by him).

The number of subscribers to stock will be limited to those who have subscribed at the time of the organization of the co operative distilling company. Any shareholder may increase his holdings of stock from the treasury during the first two months only of a fiscal year by at the same time furnishing an equivalent increase in the quantity of tar due annually from such shareholder.

Water gas tar will not in any way enter as a basis for subscription or organization, but such tar will be purchased by the distilling company on such terms as may be agreed upon. Subscribers making water gas to keep tar from such plants separate from the coal tar.

Land to be secured in Columbus, and a plant erected for distilling 15,000 barrels of tar annually, and capable of working 25,000 barrels on double time.

All tar to be delivered to the still for three (3) cents per gallon.

Company to be managed by a board of directors in the usual manner, with its complement of officers.

After paying all expenses of purchase, manufacture and sale, and setting aside as a reserve fund 20 per cent. of the net earnings, the remainder, or so much of it as the board of directors may deem proper, shall be divided as a dividend to the stockholders.

The reserve fund shall be held sacred to recover loss by fire or other extraordinary accidents, and to enable the company to pay three (3) cents per gallon for tar to its stockholders during years when the receipts of the company will not warrant such payment. When the amount of the reserve fund shall exceed 50 per cent. of the paid up capital, no more earnings shall be set aside until the reserve fund shall have fallen below 50 per cent. of the paid up capital.

The directors may buy tar from parties not members of the company on such terms as the board may deem proper.

The directory will, of course, provide for the just and equitable administrations of such details as are not specifically covered by the foregoing synopsis, and make any change therein that may be found advisable.

Plan approved,

(Signed) ....

(Date) ....

COLUMBUS, OHIO, Dec. 29, 1893.

.....

.....

Gentlemen:—The agreement on Sheet "B," hereto attached, is for the purpose of securing under one agency a large quantity of coal tar; so that, by reason of its quantity and certainty of delivery, it can be

marketed at an enhanced price over that now obtainable by companies acting singly.

The Columbus Gas Company now offers its tar at $2.60 per barrel, net, at its works. The Committee considers this a fair price for tar, on (say) a two years' contract; and believes that almost any company in Ohio would better itself by a sale at this rate. Hence we fix a general price at $2.60 per barrel, f.o.b. Columbus. Of course, Columbus has an advantage equal to the freight paid by other Companies under this agreement; but that belongs to her because there is a distillery at her door, and the advantage exists under any circumstances.

The idea is that the Committee, in its negotiations looking to a co-operative tar distillery, may have an opportunity to sell a large quantity of tar at a good price; and to be safe in offering to do so, and to be able to act promptly, we ask you, if you so desire, to sign the attached contract "B," which is, in effect, an option. It refers only to the tar which you shall produce after the date of any sale which the Committee may make, or after notice by it that your tar is sold.

This proposed sale has no connection with the distillery plan "A," only in so far that if such a sale is made the building of such a distillery would of course be indefinitely postponed.

Our authority to sell your tar would be as your agent, with powers prescribed by the document signed.

In your consideration of this, and in the signing of it, if acceptable, we ask you to act promptly. Yours very truly,

IRVIN BUTTERWORTH,
J. W. R. CLINE,
JEROME PENN,
CHAS. H. WELCH,
} Committee.

"B."

We hereby constitute and appoint Irvin Butterworth, Jerome Penn, J. W. R. Cline and C. H. Welch, being the Coal Tar Committee of the Ohio Gas Light Association, jointly, as our exclusive agent, to sell for us our production of coal tar for the year of 1894, at not less than $2.60 per 50 gallon barrel, f.o.b. Columbus, or the equivalent in price at any other point named by such agent.

It is understood that the tar controlled under this agency is so much only of the product of 1894 as may be produced after notice shall have been given us by said agent that our tar has been sold; and when so notified by said agent, we hereby agree to ship as directed any or all of said tar, as produced, in not less than car lots, in packages to be furnished by said agent or purchaser, upon the payment of said price of $2.60 per barrel.

The right to supply local demand for tar is expressly reserved; and nothing in this authority shall be construed as guaranteeing a sale by said agent.

Our yield of coal tar for 1894, for sale under this agreement, will be, approximately, ...

(Signed) .....

(Address) .....

(Date) .....

The Driving of Alternators by Gas Engines.

By J. EMERSON DOWSON, in the *Electrician*.

The opinions of electricians seem to be as conflicting on the merits and demerits of continuous and alternating current systems as were the opinions of engineers in the days when the "battle of the gauges" was fought. Happily for my peace of mind I am not a partisan of either system, but I am often consulted about the engine power required for small central stations; and as many of the proposals brought before me are for alternating currents, I have to face the question: Can gas engines be used for driving alternators in parallel? It is admitted that gas power with generator gas is cheaper than steam power, especially in small stations with light day loads; not only is the fuel consumption less per horse power used, but the stand-by loss of boilers with light loads, or with no loads at all, is almost entirely avoided. The inducement, therefore, to adopt gas power is great, and with the best type of gas engines, as now made for elecrtical work, it is as easy to drive continuous current machines as with steam engines; moreover, the dynamos can now be coupled to the engines if necessary. With alternators, however, certain difficulties present themselves, and the solution of them will, to a certain extent, depend on the co operation of electricians with the makers of gas engines.

Of course, a gas engine can drive one or more alternators as well as one or more continuous current machines; but so far as I am aware, two or more gas engines have not been used for driving two or more alternators in parallel. The trial has yet to be made, and let us for a moment consider the difficulties involved. The alternations must be at frequent intervals, and when No. 1 alternator is running with its load on, No. 2 must be brought up to the same voltage, with precisely the same speed as No. 1. With a steam engine there is at least one impulse every stroke, and the admission of steam can be regulated with great nicety, so that with care No. 2 engine and alternator can be put into step with No. 1, and the load is equalized between them.

With a gas engine working on the Otto cycle there cannot be more than one impulse in four strokes in each cylinder, and when the engine has a light load (as would be the case with No. 2 alternator before it is connected with No. 1) the impulses would be at still longer intervals. It is obvious that with two cylinders there would be twice as many impulses as with a single cylinder; and that with a double acting engine the number of impulses would be proportionately increased. With the double acting engine, however, more oil and more water must be used to prevent overheating of the pistons, and there are twice the number of gas, air and exhaust valves, as well as twice the number of ignition tubes and valves to keep in order, compared with those of single acting engines. Therefore, the extra number of impulses involves greater complication in an engine already more complicated than a steam engine, and there is greater wear and tear of delicate cams and other working parts, as well as increased working cost. However ingenious these double acting engines may be, it is tolerably certain that as they are now made they will not be used to a large extent, and for practical purposes we need only consider the well known single acting engines until something better has been devised.

Even in the double acting engine, as well as in the single acting, the 4 stroke cycle is adhered to, and variations in speed, when the engine is running light, have still to be taken account of, although they are not great if heavy flywheels are used. I do not for a moment say that alternators in parallel cannot be driven by gas engines. I do not even know that it has been tried, and I am merely pointing out what has to be considered. In the usual way, when No. 2 alternator has to take up the running with No. 1, it would not have any load on, and if the connection were made immediately after an impulse in No. 2 engine, the latter might go on happily; but if the connection were made a little before the impulse there would be the risk that No. 2 engine would not keep step, and might be pulled up by the sudden drag put on it. Such a point can only be settled by a trial on a practical scale, and to insure success it is not unlikely that a temporary load may have to be put on No. 2 alternator, by means of resistances, so as to get a steady speed and voltage before the connection is made with No. 1. This, however, is not a serious matter, as it involves little more than an extra consumption of fuel for a few minutes.

It may be said that all troubles of running in parallel would be avoided if a continuous current were used, but a low tension current can only be used within a short radius of the central station, and if a high tension current is used for the distant areas it must be transformed down for the lamps. Then if the current is continuous, the transformers must be moving machines, which have a low efficiency when working with a light load, and moving machinery must also be looked after while running. With an alternating current, however, the transformers are stationary, and the loss with light loads is less than with continuous current transformers. On the other hand, accumulators cannot be used with alternating currents; there is no reserve of current, and at least one machine must be run, however light the load may be. There is also the disadvantage that accumulators cannot be used to keep the engines fully loaded, and when they are driven with light loads their efficiency is low. There are other electrical considerations; but these I will not attempt to deal with, as I merely want to get the general bearings of the case, so as it concerns the driving of alternators by gas engines.

The use of accumulators, to a moderate extent, is, I believe, important, as they steady the current sent to the lamps, they can serve the day load, and they can keep the engine or engines connected with them fully loaded; but I know that some electricians consider that these advantages are outweighed by the trouble and loss of current due to the accumulators themselves. It may also be arranged that gas for the engine power, during the hours of light load, should be stored in a gasholder, instead of storing electricity in batteries. For the moment, therefore, I will put the question of storage on one side, and then we shall be left with the comparison that continuous current machines in parallel are easier to drive, but that high tension alternating currents are more easily transformed down for the lamps. The *via media* is often the best, and Mr. Ranken Kennedy's proposal, that a low-tension continuous current should be taken from one end of the dynamo, and low-tension alternating currents in quadrature from the other end, is at least worth

consideration. In this system the continuous current would be used for serving the district near the central station, and for charging accumulators if desired. The low-tension alternating currents would be raised to high pressure, by step up transformers, and then transformed down for the lamps in the usual way. To prevent the step up transformers working at a low efficiency during the hours of light load, transformers of small size could be used during that time.

Mr. Kennedy proposes this system of working for various reasons, electrical and economical, and I have ventured to refer to it because it seems to me to simplify the use of gas engines for producing alternating currents, as it avoids the trouble of driving alternators in parallel. Compared with a continuous current system, there is the extra cost of the step up transformers, and the loss of the current due to them; but, on the other hand, stationary step-down transformers can be be used, so that all the moving machinery would be within the central station. At the same time all or a portion of the light load could be served from accumulators, and in small stations no engine need work for several hours. On this point I think it worth while to quote Mr. Kennedy, who says: "It is a remarkable fact, not generally known, that a dynamo running from a storage battery, *i.e.*, as a motor converting continuous into quadrature current, can give, without heating, about twice the output as quadrature current that it can give when worked simply as a dynamo by a belt."

The adoption of the system would seem to depend chiefly on what will be the loss due to the step-up transformers, but what this loss may be I do not know. I understand, however, that the system has already been tried, and if those who have had actual experience of it will be good enough to make known their results, they will, I am sure, help forward the solution of this important branch of electrical engineering.

Some Aspects of the Competition of Gas with other Illuminants.

A writer in the London *Journal* remarks that among the manifold applications of the teachings of physical science to promote the convenience or ameliorate the lot of mankind for which the present century is remarkable, the provision of greater facilities for artificial illumination holds a foremost place. It is difficult, if not altogether impossible, to realize the full extent of the change that has been effected in the nightly appearance of our streets and dwelling houses during the 80 years that have elapsed since Ackermann, in 1812, lighted his premises in the Strand with gas, and thus first showed to the wondering citizens of London the practical application of Murdoch's discovery. Nor has the improvement consisted alone in the substitution of one lighting agent for another. While gas has to a very great extent taken the place of oil and candles, and is now itself being, in many instances, supplanted by electricity, it is important to notice that the consumption of the older illuminants has, after all, not suffered with the change, but, on the contrary, has very greatly benefited. And, further, increased competition has, in every case, had the effect of improving the useful duty obtainable from the illuminant, and reducing very considerably its cost. The last 30 years only have seen perhaps the most notable advance that has marked the history of both oil and candle light, in the commercial introduction of solid paraffine and of mineral oils, while, within a very recent period, wonderful strides have been made in the perfecting of lamps and in cheapening and improving the quality of burning oils. The appliances now generally available for obtaining light from oil give, it may safely be said, from 50 to 100 per cent. better results than those of a quarter of a century ago; while the cost of the oil itself is a mere fraction of what it was. It is not then surprising that oil is used for lighting to a much greater extent than before. Indeed, the combined result of improvement in lamp and illuminant has been to place oil in a very favorable position as an economical illuminant; so that while we need not fear that it can ever take the prominent place held by gas, it may yet wisely be held a formidable rival to the latter. Ignoring the drawbacks and disadvantages attendant upon lighting by oil, which are sufficiently obvious, let us consider in what its advantages consist.

Hitherto oil has necessarily been used by the poorer classes to the exclusion of gas because the former could be purchased in small quantities as required, whereas the use of gas implied a credit account, generally with some sort of security for payment; but this notable difference is in a fair way of being wiped out. Thanks to the invention of the prepayment meter in its various forms, gas is now able to compete with oil, on the same footing, in the houses of the poor.

A more distinctive difference between gas and oil, considered as rival illuminants, lies in the fact that the oil lamp contains, complete within itself, its store of combustible, while the gas burner must be permanently connected, through a continuous line of communication, with a distant store or source of gas. Thus the oil lamp is a portable luminant, and the gas burner a fixed one; and while the former may therein secure a certain advantage, it must not be overlooked that the advantage, such as it is, is attended with equal and consequent drawbacks and danger. All the same, it is open to question whether the disadvantage sometimes attending the fixture of ordinary gas lights has been sufficiently realized, and whether more might not be done in the application of flexible tubing, or by other means to overcome them, and generally to provide sufficiently varied, convenient and efficient appliances to meet all the different requirements of gas consumers. We are of course, aware that there already exists an extensive choice in the variety and elegance of gas fittings available for the favored few with whom expense is no object; but is rather the lower middle class, who form the great bulk of gas consumers, that we have in view. Nothwithstanding the competition which now obtains in the manufacture of improved gas burners and fittings, their cost is very considerable. A well appointed oil lamp, of the most recent construction, is much cheaper than (say) a good regenerative gas burner of equally elegant design.

In this connection it may be well to note that, while producers of lighting oils have done much to further the perfecting of suitable lamps for the consumption of oil, little has been done in a similar direction by those responsible for the provision of gas light. Both the regenerative and the incandescent gas burner we owe to the initiative of outsiders; nor can it be said that gas companies have done much to further their introduction and foster their growth. Indeed, it must be confessed that they have, in the past, concerned themselves far too little about the application and use of the commodity which they were content to supply. But the experience of the last few years in the promotion of cooking and heating by gas has shown that consumers are ready enough to respond to the invitation to extend the uses of gas, when wise and skilful guidance is provided. And the same result may be expected in the further and higher development of its possibilities as an illuminant, with regard to which so little has, after all, been done.

Take, for example, the lighting of churches and factories—two fields which offer ample scope for the application of all the resources of gas lighting, but in regard to which, as ordinarily practiced, there has been little or no advance made since the early days of gas lighting. Can it be doubted that, on the one hand, it is possible to effect a great improvement, as regards convenience, efficiency and economy in the lighting of such interiors; and, on the other hand, that the way to obtain such a boon only requires to be clearly shown in order to be largely followed? In nine cases out of ten a church is illuminated by a number of naked gas jets arranged singly or in clusters, and disposed about the building in exact correspondence with the candles which they originally displaced. The burners employed are necessarily of the class which develop but a fraction of the total luminosity obtainable from the gas, while the bare flames, interposed in the line of vision, produce a painfully dazzling effect on the eyes. By the application of more perfect appliances, a much higher duty might be obtained from the gas consumed, which would allow of the flame being concealed from direct sight by screens contrived to direct the rays of light where required while moderating their intensity. Thus economy and efficiency would be simultaneously secured.

We are prepared for the obvious retort, "The first cost of such appliances is at present too great, and their maintenance in perfect order too troublesome and expensive to be extensively adopted by any but the wealthy, or those who can use them for business purposes." But the same might have been said of gas cooking and heating apparatus in their infancy.

When it is clearly recognized by the proprietors of gas undertakings how intimately is the continued prosperity of their industry bound up with the fuller development of the capabilities of gas, such objections will be overcome. We have so recently had occasion to refer to the defective lighting of factories and workshops, as commonly carried out, and to advocate the devotion of more and more intelligent attention to the subject, that it need not be further dwelt upon here.

Turning now to the competition which gas has to face from its latest rival, electricity, we notice a remarkable feature which distinguishes the electric light from other illuminants—it is fashionable. Whether there ever was a time when gaslight was similarly favored, we know not; but it has certainly not been in our day. It may be due to the mystery attending the occult nature of the force itself, or to the marvellous achievements which this generation has witnessed in the various applications of electricity; but, whatever the cause, the fact remains that the favor of the public is unhesitatingly given to anything which is called electric. This must be admitted and reckoned with, after all has been said that can be in favor of electric lighting. It is also to be

noted that the popularity of the new illuminant has led to a more general employment of superabundant artificial light as a means of adver tisement for trade purposes. Whereas formerly the standard of illumination in shops and wherehouses was the minimum quantity necessary to allow of the transaction of business with sufficient despatch, it is now recognized that the brighter and more attractive such establishments are made, the more prosperous they are likely to be. In a certain sense it may be said that supply has created demand; the provisions of en larged facilities for artificial illumination having led to the adoption of a higher general standard of lighting, both of interiors and open spaces, and thus brought about an increased consumption of the different lighting agents. To this extent gas has benefited by the advent of the electric light. But more than this. Just as the most notable advances in oil lighting have been made under the spur of necessity, to prevent being left utterly behind in the race for public favor, so it has needed the stimulus of competition, with electricity on the one hand and oil on the other, to bring about the development of the most effective appliances for burning gas. And while there is no fear in our mind as to the result upon gas interests of the contest with the newer rival in the field of lighting, it is well to scrutinize forces, noting the weak places on our side, and, if necessary, adopting the tactics of our opponents in order to strengthen our position.

It is daily being shown that certain classes of users of artificial light are prepared to spend lavishly to obtain an adequate return in effective lighting; and it should be the endeavor of suppliers of gas light, not merely to *meet* their demands, but to *attract* them. It must be admitted that the promoters of electric lighting have shown remarkable enterprise, and been unsparing in the expenditure of means to show forth, on an extensive scale, the resorces of the new illuminant. It had been well if gas had earlier taken the same course of exhibiting and bringing to the notice of the public the capabilities of gas lighting. Unfortunately, the generally uninterrupted commercial success of gas undertakings, and the peculiarities of their position, conduced to a *laissez faire* policy, from which some of them are hardly yet thoroughly aroused. This lamentable defect, on the one hand, and the public infatuation for things electric on the other, have resulted in gas not only being simply supplemented by electricity, but so, in many instances, under circumstances reflecting unmerited reproach on the older illuminant.

We have in mind a mo lern instance illustrating very pointedly our meaning. One of our large commercial cities has, in order not to lag behind in the march of so called progress, recently embarked on a municipal electric lighting scheme upon a somewhat extended scale. It enjoys already the distinction of leading the way in the most admired modern methods of municipal administration of gas undertakings. It supples a gas of fairly high illuminating power, judged from the southern standpoint; and, if allowance be made for the respectable contribution to street improvements expected from the consumer, it sells gas at a reasonable figure. Now the city boasts, and with pardonable pride, a noble Library and Reading-room, likewise the property of the rate payers. Hitherto this building has been lighted, as three fourths, or we might even say a greater proportion, of our large public buildings are lighted, by means of naked gas lights furnished by almost the commonest and cheapest burners obtainable—burners developing, from the gas consumed, a duty of not more than 50 or 60 per cent. of the light yielded with the standard burner, and consequently inferior in a much greater degree to the latest developments in gas lighting apparatus. In this crude manner the building was, in general, fairly well lighted, but not at all brilliantly; some of the smaller rooms being both insufficiently lighted and ill-ventilated. Here, as it were within the gates of the proprietors of the gas undertaking, was a splendid opportunity for promoting at once economy and efficiency in service, increasing the comfort of the frequenters of the library, and showing forth on a truly magnificent scale all the resources and possibilities of gas lighting. But the City Fathers never took advantage of it. What had done, in the way of gas lighting, for one generation would do very well for another, seems to have been the accepted plea. Regenerative burners, incandescent burners, and ventilating burners might not have been invented for any use which was made of them here, where their advantages would not only have been of the greatest direct benefit, but would also have furnished an object lesson in the applications of gas to lighting and ventilation, and been a magnificent advertisement of the illuminant itself. As soon, however, as the electric light begins to loom on the distant horizon, it is discovered that improved illumination is imperatively required, and can only be satisfactorily provided by the newer and more "advanced" illuminant. Cost is not taken into consideration. If the mere thought of it cropped up in the mind of some antiquated adherent to old fashioned economics, it was ruthlessly brushed aside by the desire to "advance with the age," or was crushed beneath the weighty opinion of some distinguished scientist, who affirms that light was produced by electricity at much less cost than by gas.

Now the change has been accomplished, what do you see? Brilliantly, not to say extravagantly, lighted rooms it must be frankly confessed. Nor could any other result be looked for, when we consider the superabundance of the means employed. The principal reading-room—a noble apartment, spacious and lofty—is lighted by ten arc lamps, where formerly were five gasoliers of thirty small jets each. The entrance hall contains two electroliers, each consisting of four incandescent lamps, where before was one gasolier of three jets. In other rooms, each small gas jet has been superseded by two incandescent lamps of, we suspect, nom inally higher illuminating power. And not only so, but these latter are better distributed over the area to be lighted. Thus, compared with the gas-burners which performed the duty before, the provision of electric lamps to light the building has been on an exceedingly liberal scale; and it is therefore not a matter of surprise that the result should be regarded as eminently satisfactory from the point of view of the frequenters of the library. It ought, however, to be, in fairness, remarked that formerly there were no rude winkings of the gas lights to distract the attention of the student from his book, as occasionally disfigure the arc lights which have now supplanted them. But this is a weakness inseparably bound up with the younger illuminant, and it is patiently borne with, in the hope that it will, in time, be grown out of; although, as yet, after many years, there is no sign of "a consummation so devoutly to be wished" by electricians. Without cavil, however, we grant that the building is, on the whole, much better lighted than before. Even the gas manager must admit that the general result is a great triumph for electricity—a triumph rather overwhelming than respectable or complete, considering the disproportion of the powers employed.

But what about the cost? "Ah! there's the rub!" We are not, of course, yet in a position to form even an approximate estimate; but we shall be very much surprised if the expense of lighting by electricity, on the present liberal scale, does not amount to, at least, four or five times the former cost of gas. We should, however, be only too glad to have our estimate confirmed or set right by definite statements of the actual comparative cost of lighting by gas and by electricity in such examples as the one above indicated. And now that there are so many instances of municipalities supplying both gas and electricity, there should be somebody in authority, some member of a gas and electric lighting committee, or some superior official, who is sufficiently interested in the subject to work out the problem here presented, and both able and willing to make known the results of his investigation for the information and guidance of our readers and the gas profession generally.

In conclusion, we would urge upon all who are responsible for the continued welfare of the gas industry the lesson which is taught by the facts we have reviewed, and the thoughts we have had under consideration—namely, that more attention must be paid in the future to the appliances generally available for the consumption of gas, and that the capabilities of gas lighting must be forced upon the attention of the public. The gas consumer must be aided and guided to develop the best results possible from the illuminant; and who more likely than gas suppliers to be to the front in showing how this may be done?

Accidents in Mines.

According to the *Colliery Engineer*, the annual reports of the inspectors of coal mining give a better insight into the dangers of mining operations than any other publications. By a perusal of the reports of the inspectors of mines of the coal regions of Pennsylvania for the year 1892, we find that falls of roof and coal caused 45 per cent. of the total deaths in the anthracite mines, and 70 per cent. in the bituminous mines. Indeed, we may add that the accidents from these causes always predominate. In looking through these reports, with a view of finding suggestions for diminishing the accidents, we notice the inspectors put a great deal down to the want of care on the part of the employees themselves. For example, the inspector of the fifth anthracite district says: "Many of these accidents might have been averted by a litttle more care on the part of the victims themselves, and a little more strict discipline on the part of those in charge of the work." And the inspector of the fourth bituminous district says: "Four of the fatal accidents appear to have been purely accidental, and the others were largely due to carelessness on the part of the victims." The experience of Wm. Stein, the inspector of the sixth anthracite district, is to the same effect; he says: "Thirty-five deaths occurred by the carelessness of

the victims themselves." Again, the inspector of the eighth bituminous district says: "Of the six men killed by falls of coal, four came to their deaths by their own carelessness."

The number of fatalities by falls is certainly most serious, and demands the attention of every person engaged in coal mining. Every thinking man who remembers that in the year 1892, out of 418 lives lost in coal mining in the anthracite coal regions of Pennsylvania 191 were caused by falls of coal and rock, and that during the same period in the bituminous regions, out of 134, 95 were killed by falls, must conclude that the matter is a serious one, and that something should be done to decrease this appalling loss of life.

The inspector of the first anthracite district, Mr. Edward Roderick, has a great deal to say on this subject, which is very much to the point, and as his remarks have evidently been made after serious reflection of facts and circumstances that have come before him in his own actual experience, and practical observation, they are deserving of the most careful attention.

He says: "The number of fatal and non-fatal accidents caused by falls of coal and roof is far too great. By referring to the table of fatal accidents in this report it will be observed that, out of a total of 55, 36, or nearly 65½ per cent., were caused in this manner.

"It is a well-known fact that persons who are daily, and almost hourly, exposed to danger, become so accustomed to it as to regard it with an indifference approaching contempt. It is this consummate contempt of danger on the part of many miners that leads them to take so many uncalled for, utterly unnecessary, and frequently fatal risks, of which a description is herein given. It is frequently noticed that where no slips are visible in the top coal, it is left to overhang for a distance of 10, 15, or possibly 20 feet, more or less, without a prop to support it at the outer edge; a shot is fired in the bottom bench, which cuts a slip that runs up into and through the top coal; soon after the shot has exploded, the miner, who may not have enough loose coal to load the "next car," hurries back to the face of the breast to see how the hole "cut." In his haste he forgets, or does not think it necessary, to first examine the coal above him, inasmuch as it was safe before he fired the shot, and proceeds to work, when, without any warning, the top coal falls upon him with fatal result. In some places the top coal may be "dirty"—that is, full of streaks of rock and bone—or it may be the "buck" which is not sent out, but "gobbed" in the mine. The miner who may be working such a place, and may have a car of bottom coal ready to load, will make the miner's familiar remark to his laborer, that "the top is getting bad and will not stay up much longer, so we'll blow it down after loading the next car." But while the car is being loaded the top coal falls of itself and kills one or both.

"Then, again, it is often observed that the miners, after trying for a long time to pry down a bad piece of coal or rock, and not succeeding as easily as they thought, conclude it was mistaken judgment on their part to think it was unsafe, and so abandon their efforts and proceed to work under it, when, in a shorter period of time than it takes to record the fact, it falls and kills the miner or his laborer.

"Another somewhat prolific cause of fatal casualties is procrastination in regard to propping. Oftentimes when a miner knows very well that a prop should be stood in a certain place to secure the roof, he will put off standing it until he has loaded another car, or has drilled and fired another hole, or, as it would appear, until some other seemingly more important duty than standing a prop to insure his own safety has been performed. Very few accidents occur where there is very bad roof, for in such a place the miner is always on the alert for danger, and keeps his props well up to the face; but, on the other hand, where the roof is apparently good, the propping is neglected, falls occur, and very severe and oftentimes fatal accidents are the result.

"No roof in this district, however good it may appear, can be trusted without a goodly number of props. In some of the mines it is of a brittle, slaty nature, in others it is fireclay, with an abundance of the treacherous sulphur balls and 'smoothes,' while in a few it is sand rock filled with water seams and slips, owing to the shallow covering on the veins. None know nor understand better the ways and habits of miners than the thoroughly practical mine foremen, and none can do more towards lessening the number of accidents from falls than the mine foremen themselves. I would, therefore, urgently recommend that each mine foreman adopt stricter rules governing propping, and the taking down of top coal, and that a strict discipline be enforced in this respect with a view to reducing the number of accidents from this source to a minimum in the future. As a rule for propping, I would recommend that props be stood in regular rows, the distance between props to be regulated by the nature of the roof; and as for top coal, it should not be left to overhang for any length of time in any place without props to support it while mining out the bottom bench. If these rules were adopted and rigidly enforced in all our mines the number of deaths by falls of all kinds would without any doubt be far less numerous in the future." If these recommendations be carried out and greater discipline practiced, there is certain to be a diminution in the number of accidents from falls.

The reports show us further that a large number of accidents are caused by persons being crushed and run over by mine cars; thus in the anthracite region, out of 418 deaths, 69, or 16½ per cent., were due to cars, whilst in the bituminous region out of a total of 134 lives lost by mining, 24, or 17¾ per cent., were caused by mine cars; but from information contained in the reports it is evident that the fatalities which come under this head were greater than they would have been had proper care been exercised. For example, the inspector of the second bituminous district records that "four men were killed by jumping on moving trips, and as long as men continue to act so carelessly and in spite of all caution violate every rule of the mines, I don't look for much decrease in the number of accidents, with all the care on the part of the mine officials to protect human life, unless the warnings given by them are heeded by the miners and others." The inspector of the eighth bituminous district says, "the deaths by mine cars could have been prevented with ordinary presence of mind."

The suggestions of the mine inspector of the first anthracite district in his report on the subject are so much to the point that we here repeat them:

"I wish to say a few words against the dangerous practice that prevails among the drivers in some of the collieries of this district, and which is frequently the cause of injuries to this class of employees. It will be remembered that when the mine law was revised in 1885, a new clause was inserted preventing after a certan period of time the use of any mine car the bumpers of which were not of sufficient length and width to keep the bodies of said cars separated by not less than 12 inches when the cars stood on a straight, level road. This very good clause is also contained in the present law, and undoubtedly has been the means of reducing the number of accidents caused by being squeezed between cars. But while this is true, it may well be questioned whether the number of accidents caused by being run over by the cars has not increased, owing in a great measure to the use made of the long bumpers by the drivers in and around some of the collieries. They will sit on the bumpers of moving cars with one foot on the spreader and the other sliding along the rail, and they frequently can be seen with both feet upon the spreader chain, riding along thoughtless of any danger, when suddenly their feet slip off and they are thrown under the cars and seriously if not fatally injured. This was the case in 1892, when one was killed and four others were so seriously injured that amputation of leg or arm was necessary."

A due observance of the provisions of the law will tend more than anything else to diminish the number of these accidents. Many of the occurrences have been anticipated by the Legislature and are provided for in Rules 46, 47, 48, 51 and 52 of the anthracite mine law, and Rules 17 and 19 of the bituminous mine law of Pennsylvania.

The deaths by explosions in the anthracite regions in 1892 formed 13¾ per cent. of the whole. In the bituminous regions there was only one death from this cause out of 134—that was in the seventh district; the man killed was a fire boss, and the inspector speaks of the occurrence as follows: "This mine at this time was generating explosive gas very freely, and no open lights were allowed in the mine. The deceased was in the habit of taking with him during his rounds of examination both the Clanny and Davy safety lamps, and he had both lamps with him on this occasion. It is generally supposed that either a piece of slate fell and broke the Clanny lamp, bringing the gas down with it, or that he lifted one of the lamps into a body of gas and accidentally dropped it, causing the flame to pass through the gauze and ignite the gas by reason of the lamp passing through the explosive mixture at a high velocity. Both lamps were badly broken by the concussion, but both parts of each lamp were found to be firmly screwed together. The inside gauze of the Davy lamp, although disconnected from the other parts, was found to be without any defect in its apertures or construction. The gauze of the Clanny could not be found. I found upon investigation that the deceased had spent nearly half an hour in taking both lamps apart and examining and cleaning their several parts before he went into the mine on the fatal morning."

The most serious explosion during the year was that which took place at the York Farm Colliery, in the eighth anthracite district, on the 23d of July, by which 15 persons were killed. The inspector entertains no doubt as to where the gas was ignited, but, as he says, the manner in which it was fired will never be known with any degree of certainty. Very little firedamp is found in the first anthracite district, and conse-

quently explosions there are very few. In the third anthracite district the quantity of air has been increased by substituting larger ventilators, which is a very effective way of improving the ventilation of mines. At the Dodson Colliery, in the fourth anthracite district, and at East Boston and Black Diamond Collieries of the third, the plan of filling the old workings with culm washed in through bore holes or pipes hung in the shaft, has been put into practice, which is not only successful in keeping up the roof, but precludes the possibility of the mine becoming a magazine for gas, which is a matter of great importance in fiery mines.

Mr. Williams makes some very useful and practical remarks on the subject of blasting. He says: "Dynamite in its various forms is found to be safer and less liable to ignite the gas. It should not be used at a temperature below 40°, because then it is more liable to ignite the gas. Even when its temperature is proper it should never be exploded where there is a body of firedamp. If a blast has less work to perform than is necessary to consume the energy of the explosive, it generates heat enough to ignite firedamp. It performs eight times as much work as powder, and does it much more suddenly."

On the subject of dust Mr. Williams says: "We have not yet found that the dust of anthracite coal promotes explosions, but it may assist to intensify the heat of the gases in an explosion; and if it does, the expansion is enhanced and a greater force is developed, increasing its destructive power."

As to the quantity of air necessary to be circulated through the ramifications of a coal mine, we observe that the inspector for the eighth anthracite district says: "Most of the fiery mines require much larger volumes than the minimum quantity provided for in the Act of Assembly;" a remark with which we entirely agree. One of the inspectors recommends that a clause be put in the proposed new law for the bituminous mines to the effect that mine bosses be re-examined every four years, which he thinks would be a step in the right direction, and would result in mines and miners being better looked after and cared for.

Geological Distribution and Natural Storage of Gas.

[Mr. J. D. Weeks, in "Mineral Resources of the United States," for 1892."]

As to the localities in which natural gas is found, it may be said in a general way that this substance has been found in varying quantities from the Hudson River on the east to California on the west. In Alabama, California, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Missouri, New York, Ohio, Pennsylvania, South Dakota, Tennessee, Utah, West Virginia, Wisconsin and Wyoming its existence is reported. In some of these States, however, it has not been found in commercial quantities. A shallow well, frequently a well put down for water, has shown the existence of gas, usually in the drift. In many cases also so-called gas springs have been found, from which a small supply of natural gas, usually marsh gas, is reported. In 1889, gas in commercial quantities was reported as having been produced in Arkansas, California, Illinois, Indiana, Kansas, Kentucky, Michigan, Missouri, New York, Ohio, Pennsylvania, South Dakota, Texas and Utah. At the present time the important gas fields are those of Western Pennsylvania, Western New York, Northwestern Ohio, and Eastern Central Indiana. It is the development of these districts that has caused the excitement in connection with natural gas which was so manifest in 1888 and to a less degree in 1889. The most important gas fields in these territories are those in the gas district in Pennsylvania in the neighborhood of Pittsburgh, including the Murrysville and Grapeville fields of Westmoreland county, and the several Washington county fields. In McKean and Venango counties there was also a large production of gas, and considerable from Elk county. In Ohio, the most important field is what has been called the Findlay, situated in Hancock county, while in Indiana the chief fields are in the neighborhood of Anderson, Kokomo, Marion and Muncie. Each of these districts, as well as the other localities in which gas is found, will be discussed in connection with the report on the several States.

It has not been considered necessary to discuss the question of the origin of natural gas. This is, strictly speaking, a chemical question. It can be said, however, that the general belief is that the gas, as well as petroleum of the Pennsylvania and adjacent oil fields, is of vegetable origin, while the gas of the Indiana oil field is of animal origin. In a word, the gas stored in the sand rocks of Western Pennsylvania is derived from vegetable matter, while the gas stored in limestone is of animal origin. Nor has it seemed necessary to discuss whether natural gas was produced in the years or ages past and stored for present use, or whether it is still being produced. Possibly both suggestions are correct, and it is also probable that the very large amount of gas which the drill has brought to the surface of the earth in the last few years was formed years ago and has been stored in the natural reservoirs until the drill found it. No doubt some gas is still being produced; especially is this true of the shallower wells.

Whatever, then, may have been the origin of natural gas, there are certain conditions necessary to its accumulation and storage, and if any one of these is absent no large supply can be expected. Small amounts of gas can exist without the presence of one or more of these conditions; but these pockets will yield but a small supply and that supply will very soon be exhausted.

These vital conditions are three: (1) reservoir; (2) cover; and (3) structure.

Gas is not stored, as is often supposed, in cavities or caves in the strata of the earth's surface, but chiefly in porous sandstones and limestones, gas as well as oil being found in the small interstices between the grains or in the pores.

The reservoir rock in Western Pennsylvania is almost always a sand rock. The storage reservoir in Ohio is the Berea grit and the Clinton and Trenton limestones. Some little oil is found in shale, but the two great reservoirs in which the natural gas supply of the United States is stored are the sand rocks of Western Pennsylvania and the Trenton limestone of Northwestern Ohio and Eastern Central Indiana. When the "sand" in which an oil or gas is found is named, a sand rock or sand stone is meant, not sand in separate grains.

It is evident at once that were the whole structure above these reservoir rocks permeable, either through its entire structure or at points, by reason of the breaks and fissures in the strata, the gas would constantly escape from the reservoir and it would soon be drained out. This is a phenomenon that is constantly noticed in connection with gas springs. The gas is leaking from the reservoir; hence it is evident that there must be a cover or cap to this reservoir to hold the supply in place, and that this cap must be impervious to the gas, or practically so, either from the absence of porosity or the absence of breaks and fissures. This cover is usually a shale, and in every important gas territory the reservoir rock is capped by a shale cover, which has retained the gas in place until the cover has been tapped by the drill. In Ohio, for example, the Cuyahoga and Berea shales cover the Berea grit, the Niagara shale, the Clinton group, and the Utica shale the Trenton limestone. As a rule, with, of course, limitations, the deeper the storage rock and the closer to it the shale or cover the larger the deposits of gas and the greater the chance for their permanence.

A third factor comes in here, which is termed structure, or the arrangement of the rock that contains the gas. The existence of arches and troughs, or, in geological language, of anticlines and synclines, has long been noticed in connection with drilling for petroleum, and recently in drilling for natural gas, as well as their influence upon the storage of these hydrocarbons. The most effective statement of this influence of structure, or, as it may be called, the "anticlinal theory," was made by Prof. I. C. White, of Morgantown, W. Va. Though his statements were called in question, his theory commended itself to practical men, and its adoption led to the location of a considerable number of natural gas wells far in advance of the developments of the drill. This theory simply asserts that oil, and more especially gas, is to be found stored most largely in the apex of these anticlines. The great reservoir of the Trenton limestone gas in the Ohio field is found in an enormous anticline, as is noted in discussing the Trenton limestone in connection with the report on Ohio.

A fourth necessity is pressure. It may be briefly said here that salt water is found in the outer boundary of gas and oil fields, and it is to the presence of this water that the pressure of oil and gas is ascribed by most of the geologists of Ohio and Indiana, though some of the Pennsylvania geologists question its sufficiency. Dr. Phinney, of Indiana, holds that the initial pressure of many gas wells is about that of the weight of a column of water equal in height to the depth of the well.

Mineral Wool: What it is and its Uses.

"W.," in *Architecture*, furnishes the following interesting tables: What is known in the United States as mineral wool and in England as silicate cotton is manufactured from the slag of iron furnaces by fire and steam. Analysis of the slag shows a mixture of silica, alumina, lime and magnesia in various quantities with further additions of limestone. It is smelted in a cupola, and as it runs from it is caught by a very powerful jet of steam, which is the controlling medium.

Relative Efficiency of Materials which Prevent the Waste of Heat in Greater or Less Degree.—Made by Prof. John M. Ordway, of Massachusetts Institute of Technology, for Boston Manufacturers Mutual Fire Insurance Company.

No.	SUBSTANCE.—One Inch Thick. Heat Applied, 310 Degrees F.	Pounds of Water Heated 10 Degrees F. per Hour, by Transmission through One Square Foot.
1.	*Loose wool*	3.1
2.	*Live Geese Feathers*	9.6
3.	*Carded Cotton Wool*	10.4
4.	*Hair Felt*	10.3
5.	*Loose Lampblack*	9.3
6.	*Compressed Lampblack*	10.6
7.	*Cork Charcoal*	11.9
8.	*White Pine Charcoal*	13.9
9.	*Anthracite Coal Powder*	35.7
10.	Loose Calcined Magnesia	12.4
11.	Compressed Calcined Magnesia	42.6
12.	Light Carbonate of Magnesia	13.7
13.	Compressed Carbonate of Magnesia	15.4
14.	Loose Fossil Meal	14.5
15.	Crowded Fossil Meal	15.7
16.	Ground Chalk (Paris White)	20.6
17.	Dry Plaster of Paris	30.9
18.	Fine Asbestos	49.0
19.	Air alone	48.0
20.	Sand	62.1
21.	**Best Slag Wool**	**13**
22.	*Paper*	14.0
23.	*Blotting Paper, wound tight*	21.0
24.	*Asbestos Paper, wound tight*	21.7
25.	*Cork Strips, bound on*	14.6
26.	*Straw Rope, bound spirally*	13.0
27.	*Loose Rice Chaff*	13.7
28.	Paste of Fossil Meal with Hair	16.7
29.	Paste of Fossil Meal with Asbestos	22.0
30.	Loose Bituminous Coal Ashes	21.0
31.	Loose Anthracite Coal Ashes	27.0
32.	Paste of Clay and Vegetable Fiber	30.9

The loss is indicated by the length of the lines. Incombustible material designated in Roman type; material which may be ignited, in italics.

Mineral wool is used for insulation of heat and cold; for fireproofing and frostproofing; for the deadening of sound and verminproofing, and for the prevention of dampness and the propagation of disease germs. It is indestructible and odorless. With these incontrovertible merits why is such an invaluable article so much neglected by architects and builders? By many it is considered expensive, and by some builders as an unnecessary expense, or perhaps more practically expressing it, an unprofitable outlay, they stating that if it was used by them they could not get any returns therefor when selling their property. This may be so until the public has learned to know and appreciate the difference between lined and unlined houses, and create a demand for the former.

Why should people who occupy upper floors in flats or sleep in upper rooms any longer endure the extreme heat in summer and cold in winter, when by lining the roof with 2 or 3 inches thickness of mineral wool these apartments may be as cool in summer and as warm in winter as the rooms beneath? (The mineral wool will keep in winter the heat that ascends from the lower parts of the house and prevent its escaping through the roof and upper rooms.)

The cost is insignificant when compared with the comfort derived from the use of this material (two or three inches thickness only costs three or four cents per sqaure foot), the first outlay being the only one. Again, its use between studding in the walls prevents the rapid spread of fire, which is so general in frame houses (and too often fatal), because the space between each stud is the same exactly as so many chimney flues, and draws the fire from bottom to top of the house in very short order. Now, if these spaces were filled in with mineral wool, which is non-combustible and fireproof, only two or three feet above the floors, these open draughts would be effectually stopped.

It is a wonder insurance companies have not considered this matter as they should do. If they looked into the merits of mineral wool, they would no doubt become easier in their rates, and certainly their losses would be largely diminished.

Prof. John Ordway, then of the Massachusetts Institute of Technology, some time ago made tests of the various materials in the market as insulators of heat (and per contra of cold). The results are given in the accompanying table.

The *Scientific American* (Architects and Builders' Edition), telling how to keep out the heat in summer and keep it in winter, says: "It is quite as important to build a house so as to keep out the heat in summer as to keep it in in winter. Few architects seem to think of this point, and it is quite common to hear one say that a poorly-built house is a cool house. This is not so, but the contrary is true. It is a rule that the attics of our houses are veritable ovens, and so long as nothing but a thin coat of mortar and occasionally a poor board floor separate the sleeping-room from the attic, the former will approach in temperature very nearly to the latter. This difficulty can be overcome very easily and quite inexpensively. Mineral wool placed between the rafters is an absolute preventative of such a condition of affairs, but one who is building a house should not stop here with the use of this material, for its low cost and its many desirable qualities should commend it for use throughout the house wherever cold and dampness are to be kept out and heat is to be kept in in cold weather and out in warm weather. The fire-resisting qualities of mineral wool have long commended it to architects for this specific purpose, but in our opinion this is the least of its qualities, although it is an absolute resistant of fire."

No doubt the above quoted article has had some influence with architects and builders, but still there must be many skeptics, or the use of this material would be much more general.

The extensive brewers and packers in the West use it at all times and in all places where they can in lining their cold storage packing and ice houses, some to the extent of millions of pounds. Transportation charges must make the cost more to them than it would be hereabouts. In steam pipe and boiler covering mineral wool has proved to be very desirable. The New York Steam Heating Company has covered all its pipes with this material, thereby reducing the consumption of fuel and expenses so much that the mineral wool is soon paid for, and after that, more profit.

It is also used in boiler and pipe covering in the British Navy and to a smaller extent in the U. S. Navy; in all probability more will be used. The Pennsylvania Railroad Company line their passenger and refrigertor cars with it. It is also invaluable as a deadener of sound in floors and walls of theaters, public halls, lodge rooms, etc. Do not forget that it is fireproof when considering its deafening properties. New uses to which this material is applied come to light continually. Recently when in conversation with a prominent architect of Brooklyn, N. Y., he told the writer that he had experimented with mineral wool in a cement floor by laying cement, then a layer of mineral wool and covering that again with cement. This was done to test its frost-proof qualities. Asked if it was a success he answered, yes. Cinders had been previously used, but he found the mineral wool would give and take better in expansion and contraction.

In southwest Virginia mineral wool came into great demand for the purpose of keeping out rats, mice and vermin, and for this reason alone the users thought it worth all it cost. No doubt many who read this, as well as the writer, when living in country houses, have been disturbed in the night by the rats running up the walls and between the floors and ceilings, and sometimes have experienced the even greater nuisance caused by the effluvia of a dead rat. For the prevention of

these pests the coarsest grade of slag wool is the best. It is so irritating to them by reason of its penetrating qualities that they will not come near it. Much more might be said about this material, but what has already been herein stated should be sufficient to excite inquiry into its merits, which will necessarity lead to a largely increased demand.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, January 10, 1894.

Certified Standard Candles.—High versus Low Pressure Storage.—Gas as a Fuel.

"Better late than never" is a proverb that comes into use much oftener than it ought to do, and is particularly applicable to a recent action of the London Gas Referees, who are now about to discharge a duty that should have received prompt attention at the time of their original appointment, in 1860. It is strange that during the last 34 years, although they have gone most minutely into details of the construction of photometers, the standard used, which is the *crux* of the whole requirement, has remained untouched. Especially is this the case when it is remembered that it has been the subject of almost ceaseless complaint. The operating examiners themselves have been bitter in their denunciations of the candle. It is well known that an important proportion of the candles supplied to these gentlemen fail to comply with the standard conditions, and are rejected in consequence. Gas companies on the one hand and the representatives of the consumers on the other, have had their fling at the unlucky candle. If there is a discrepancy between the tests of one examiner and another, the "candle" gets the blame of it. If the gas company send out gas below the standard, and are summoned for the default, the defending counsel, among other excuses, has his kick at the candle. And if the popular view of the quality of the gas supplied does not agree with the official returns, the unfortunate candle is again in the wrong. Yet it has been repeatedly pointed out that some of the defects laid to its charge are due to the unfortunate position it is called upon to assume, and that others would be done away with by more stringent regulations as to its manufacture. But no advance has been made beyond the old definition of "sperm candles of six to the pound avoirdupois, burning at the rate of 120 grains per hour." Many elaborate inquiries have been undertaken with a view of elucidating various points in connection with the capabilities of the "candle" as a photometrical standard, but in all cases the operators have been satisfied to take the candles as they are, notwithstanding the known facts that the manner of preparing the wicks, and little variations in the specific gravity and melting point of the sperm, have a marked effect on the result. Some of these researches embrace several thousand tests, and their value would have been greatly enhanced if more accuracy had been directed to the preparation of the candles used. Until the present time no attempt has been made to regulate or define the simple points in connection with the manufacture of the candles, nor would the Referees have undertaken the work now if it had not been forced upon them.

It is one of the duties of the London County Council to supply candles for the use of the Gas Examiners, and it appears that they have on recent occasions sent out candles of a different make to those generally delivered. Although the articles complied with the meager conditions above named, they yielded a different quality of light, and several returns of "below standard" were the result of their use. The gas companies concerned, very naturally, took advantage of their right to appeal to the Chief Gas Examiner, and asked that the tests in question might be rejected, on the ground that the candles used were of a different manufacture to those usually employed, and had not been presented or certified by the Referees. This gentleman allowed the objection, and the County Council thereupon called upon the Referees to prescribe and certify the candles to be used, as provided by an Act of Parliament passed nearly 20 years ago. In reply to this demand the Referees have issued a notification,[1] specifying rigidly the way in which the wicks are to be prepared and plaited, the weight of the wick and the percentage of ash it may contain, the material to be used in preparing the candle, the specific gravity of the finished article, and several other details. They further undertake to examine the candles before use, to see that these conditions have been complied with. They thus illustrate the force of the objection to the unqualified condemnation of the candle, for it has long been a matter of general knowledge that such details as the quality of cotton used, the way in which it was plaited, the specific gravity and melting point of the spermaceti, etc., all of which admit of definite specidcation, are largely concerned in the variations of one candle as compared with another, which have so frequently been complained of.

It remains to be seen whether the conditions prescribed by the Referees are such as will secure the use of candles of similar quality, in a light-yielding sense, to those hitherto employed, and thus lead to the maintenance of the present unit of light; or whether they open the door for the admission of the higher-power candles that have been the cause of the raising of the points in question, and thus have the effect of raising or increasing the standard. If the latter is the case, the gas companies will of course protest, as the raising of the quality of the article they supply to meet the new conditions, will mean a new and heavy tax on their already burdened resources. In common fairness, any new prescription must leave the standard practically unaltered. This point has been contended more than once, and hasn't yet been urged for the last time.

A suggestion from "a gasholder builder" has been going the rounds of the engineer press, having reference to the possibility of improving on the present methods of storing gas. This subject is a matter well worthy of discussion, for the cost of storage as represented by the interest chargeable upon the large capital involved in the structure of gasholders, is sometimes as much as that of making the gas. This gentleman has been travelling in a railroad carriage lighted by means of compressed oil gas, supplied from the usual steel reservoir carried under the floor. From the gas jet his mind appears to have wandered to the steel cylinder, and from thence to sundry large gasholders that were passed on the route. Comparisons were thus suggested, which turned to the disadvantage of the latter, and the writer was led to unburden himself of several points in favor of high pressure as compared with low pressure storage. The ideas expressed are somewhat peculiar, as coming from one who claims, by his *nom de plume*, some practical knowledge of the matter, and it is remarkable that "a gasholder builder" should go out of his way to condemn the present system, and especially that he should speak of the same as being highly dangerous while extolling the high pressure system as perfectly safe. Under the present system the first cost is high, but that of repairs and maintenance is small, while the risk of danger or inefficient action is so slight as not to be worth consideration. But the plan of storing under high pressue does not secure these advantages. The reservoir to take gas at say 150 pounds pressure would be only one-tenth the size, but certainly more than one-tenth the cost of a gasholder; and in addition a large building containing boilers, engines, compressing pumps, and expansion valves would be required, which would rather hit a hole in the balance. The whole arrangement, fitted complete, would not come far short of the cost of the orthodox holder and tank. But this is not all. I have never heard how the cost of compression works out per 1,000 cubic feet in the case of the railway companies, but it is obvious that there is a continual charge for fuel, water, wages, wear and tear of machinery, to say nothing of possible depreciation of the quality of the gas by compression and subsequent expansion. It should also be observed that most of the railway companies are also makers of gas by the ordinary process on quite a respectable scale, and that after years of experience with high pressure storage, they invariably prefer the usual system, and do not resort to compression except for the rolling stock. When we see the railway engineers putting down reservoirs instead of gasholders, at their large stations and manufactories, it will be time enough to consider the possibility of substituting high for low pressure storage.

If the recent coal strike has been a cause of anxiety and expense to the sellers of gas in one way, it has been a help to them in another, for it has certainly directed attention to the comfort and convenience afforded by gas stoves for cooking and for warming. Now that the quarterly accounts for the three months ended December 31st are being totalled up, a distinct advance is noticeable, and further examination shows that such advance is due to the increased use of gas stoves. The weather during the period in question was fairly mild, and it is possible that the majority of householders, indignant at the artificially exorbitant prices that were demanded for coal, limited their consumption of that mineral as much as possible, and resorted to gas and other agents as a means of helping to that end. In many parts of the country large quantities of wood have been used as fuel, so that, altogether, the consumption of coal must have been largely reduced. When once the saving of labor, the cleanliness and the reliability of gaseous fuel has been experienced, there is a disinclination to go back to solid fuels. During the last few weeks, also, the increased interest attaching to gas as a fuel has been in evidence in our scientific papers. At no previous time has so much space been devoted to this subject, and one of the most recent contributions I have noticed is a paper[1] on gas for purposes other than lighting, from the pen of Mr. Thomas Fletcher, of Warrington, which appears

1. See JOURNAL, Jan. 8, p. 41

1. See JOURNAL, Jan. 15, p. 81.

in *Hygiene*, a magazine devoted to questions of sanitation and health. The improvement in gas appliances for such purposes, which it has been my privilege to chronicle from time to time, still continues. Several new designs have been placed on the market in the present season. The result is an important increase in the quantity of gas required during the hours of daylight, and there is every probability that the new business is of a permanent character.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

COLONEL W. A. STEDMAN has been appointed Superintendent of the Flatbush (L. I.) Gas Company.

AT the annual meeting of the Conneaut (O.) Gas Light and Fuel Company the following officers were chosen: Directors, John Olmsted, M. Dorman, W. A. Ward, F. M. Olmsted and S. J. Smith. President, John Olmsted; Treasurer, S. J. Smith.

SOME time ago we reported that Mr. W. S. Waterbury had purchased the plant and franchises of the Ballston Spa (N. Y.) Gas Company, and we may now add that he has taken possession of the property. He will improve the plant, with the object of enabling him to reduce the gas rate.

SOME days ago the New York *Evening Post* printed the following: "A case involving difficult questions of engineering and contract making has just been decided by the verdict of a jury before Judge Shipman, of the United States Circuit Court. The case is brought by McLaughlin, Reilly & Company, contractors, against the East River Gas Company, to recover damages for deceit and breach of contract made between the parties for building a tunnel under the East river. The object of the tunnel was to enable the East River Gas Company, which is a Long Island Company, to bring its gas from Long Island City and distribute the same in competition with the New York Companies. The tunnel has attracted considerable attention during the past year because many man have been taken out nearly suffocated to death. The plaintiffs claimed that they had entered into the contract with the defendant upon the representation that the entire tunnel was to be built through rock. As evidence of this they showed a plan upon which they bid, which was made by the Company's engineer, and stated that the tunnel was all solid rock. The plaintiffs and two witnesses also stated that the engineer told them that he had made borings and soundings in the East river, and that the tunnel was all solid rock. It appeared to be conceded that after the work had progressed a distance of 400 or 500 feet the material to be tunnelled was of soft earth and not rock. Plaintiffs claimed that when this material was reached the defendant agreed to pay them their expenses for the use of their plant and a fair profit on the work. The defendant denied this statement, though it appeared they had followed out a line of payments such as would make the contract similar to that claimed by the plaintiffs. The cost of building a tunnel in earth was proved to be over $800 a linear yard greater than in rock. The contractor's price was $69 per linear yard for the rock, and it was conceded on the trial the actual expense in earth was $900 per linear yard. The defendant claimed that instead of owing the plaintiffs anything the plaintiffs owed them $50,000. The court refused to allow the question of deceit to go to the jury, upon the ground that the statement made was a matter of opinion and not of fact, but dismissed the defendant's counterclaim. The verdict was in favor of the plaintiffs for $5,800. Messrs. Kellogg and Rose appeared for the plaintiffs and W. J. Kelly for the defendant."

MR. A. PIERCE, of Oroville, Cal., died suddenly in San Francisco, about a fortnight ago. Deceased was a native of Philadelphia, and went to San Francisco in 1849. He subsequently became prominently identified with various enterprises in the northern part of California. He built the gas works at Oroville, Grass Valley, Nevada City and Santa Rosa, and held one-third interest in the gas and electric light works at Marysville. At the time of his death he had disposed of all save his interests at Oroville and Marysville, and was President of the first named Company. He was in his 76th year. The remains were forwarded to Philadelphia for interment.

THE proprietors of the Carlisle (Pa.) Gas and Water Company have authorized a reduction in the gas rate of 50 cents per 1,000 cubic feet, which means a charge of $1.50 per 1,000. It is also agreed to that when the bills of a consumer amount in value to $100 a year, a rebate of 5 per cent. is to apply, and where the annual consumption is $200 and over the discount is increased to 10 per cent. The Company will also extend its main system.

THE authorities of Richmond, Va., have passed a resolution appropriating $35,000 for enlarging the purifying capacity of the city's gas plant.

A NEWS item from Grand Rapids, Mich., is to the following effect: "Negotiations have been opened by Eastern capitalists, whose representatives were here a few days ago, for the purpose of purchasing a controlling interest in the Grand Rapids Gas Company. Nothing definite in the way of terms has been arrived at, and no option on stock so far as heard from has been given, but it is expected that trusted agents of the capitalists interested will be here soon to look over the plant. Similar negotiations were entered into by other parties about three years ago, and an option was given; but the capitalists interested failed to appear on the day appointed for the closing of the deal, and the money put up was forfeited. The Gas Company here is one of the best managed in the State, and gives a service which for general satisfaction to patrons and efficiency has few equals in the country. Under the public spirited management the price of gas for lighting and fuel has steadily been reduced until the city enjoys what few cities better situated can boast of—dollar gas. The present Company was organized about 35 years ago. Its original charter expired in 1889, and it was then reorganized with a capital stock of $600,000, distributed among 40 or 50 different holders. The largest holders are Messrs. Martin A. Ryerson, of Chicago, and Thomas D. Gilbert and Robert Howlett, of Grand Rapids. The capital stock represents approximately the actual value of the property without dilution. For several years past it has paid annual dividends of 10 per cent. Several of the stockholders have set a price upon their stock, but it is understood those who have thus far agreed to sell do not represent a majority of the stock. The price set is not given, but it is understood to be considerably above par. If the sale is made the Company will be capitalized at a materially higher figure than at present."

AT the annual meeting of the Gas Light Company, of Syracuse, N. Y., the only change made in the Board of Directors was the naming of Mr. Allen C. Fobes, who succeeds to the vacancy occasioned by the death of his father. Mr. A. A. Howlett was re-elected President; Mr. A. C. Wood was again chosen Vice-President and General Superintendent; and Mr. H. N. Babcock succeeds himself as Secretary and Treasurer.

ARTICLES incorporating the Trapp Climax Gas Producer Company have been filed with the authorities at Tacoma, Washington. The projectors are Messrs. Samuel M. Trapp, Gustav E. Kelly, Simon Donan and Hugh J. Donan. The concern is capitalized in $100,000, and its purpose is "to manage, sell, use, manufacture and lease a certain invention for the manufacture of gas for fuel."

A QUEER action-at-law is reported from Chicago, where one Harvey A. Varnell, who keeps a saloon on Clark street, asks the Circuit Court to issue an injunction to restrain the Economic Fuel Gas Company from cutting off the supply of fuel gas to his premises. He asserts that the agent of the Company, who induced him to fit his place up for the use of fuel gas, did so by representing that fuel gas would not cost any more than the coal did that he was using, and then avers that in September his gas bill was $100, and in November it was $168.96, whereas his coal bills formerly averaged $70 per month. The Company insisted that he pay for the gas used, else accept the alternative of no service. A temporary injunction was issued. In the meantime what has the "average monthly coal bill" to do with a monthly gas-bill; particularly in the instance of the month of November, which is a decidedly bleak one in the Chicago region?

NOW that the dollar gas rate has been decided upon for Philadelphia, the reformers have raked up another pet project, which is the establishing by the city of an electric lighting plant. The movement is being projected on the petition line, copies of the following document having been placed in many of the prominent public places for the signatures of anybody, and everybody, if possible: "We, the undersigned, citizens of Philadelphia, do hereby respectfully petition your honorable bodies [meaning the Select and Common Councils] for the establishment, at the earliest practicable time, of an electric plant in the city of Philadelphia, to be constructed and owned entirely by the city, and operated by its properly constituted authorities, under strict civil service rules, for the purpose of lighting the streets and public buildings of the city, and for the additional purpose of selling electricity at the lowest practicable

price to private parties for light and power, under suitable restrictions and conditions."

HOLDERS of shares in the Consolidated Gas Company, of Baltimore, Md., should not pay any attention to the rumors that the Legislature is likely to grant a charter for an opposition gas company in that city. These rumors are merely intended to exert a depressing influence on Consolidated shares, so that certain manipulators may buy them in, very much as they did four years ago. The Company is in splendid shape at present, and in our belief the stock would be cheap at 70. We have none of it for sale, let it be understood.

THE annual meeting of the stockholders of the San Francisco Gas Light Company was held on the 11th inst., at the offices on First street, with a majority of the stock represented in person. President Crockett opened the meeting with a brief address upon the standing of the Company, financially and otherwise. He reviewed the success attained by the management during the many years of strife and bitter competition from many sources. In the course of his remarks he took occasion to recall many incidents which well illustrated the zeal and ardor with which the affairs of the Company had been handled while overcoming the many obstacles in the way to prosperity. Secretary Barrett having submitted his annual report, and election for officers was held, with the following result: Trustees, Messrs. Adam Grant, Joseph B. Crockett, Levi Strauss, George W. Prescott, Daniel T. Murphy, A. H. Payson, M. D. Harvey, and W. G. Barrett; President and Engineer, Joseph B. Crockett; Secretary and Treasurer, William G. Barrett. After the adjournment the shareholders partook of a luncheon, at which the proceedings were pleasantly informal.

MR. AUGUSTUS G. RICKEY, a prominent lawyer of New Jersey, and largely interested in the Trenton (N. J.) Gas Company, died on the morning of the 15th inst.

THE West Manayunk Gas Company, which does business in the Manayunk district of Philadelphia, has reduced its selling rate to $1 per 1,000 cubic feet.

MR. S. E. STEVENSON, for the past 5 years Engineer of the Montreal Gas Company, a post which he came out from England to assume, and in which he is understood to have given satisfaction, is, at the instance of the Company, severing his connection with it.

THE proprietors of the St. Helena (Cal.) Gas Company, in response to an invitation from the authorities, submitted proposals for the public lighting by gas as follows: $3 per post per month for lighting until 12 o'clock midnight; $6 per post for all night and every night. The selling rate at St. Helena is $4 per 1,000 cubic feet.

THE Modesto (Cal.) Gas Light Company offers to supply gas to the court house buildings at the rate of $4 per 1,000; and the Modesto Electric Light Company offers to light the buildings at 20 cents per 1,000 watts, meter measurement, and will renew lamps at 20 cents each.

THE Thomson-Houston Electric Light Company, of New York city, is virtually bankrupt, and its affairs will be settled by a receiver. The Company defaulted in its interest payments last September.

AT the organization meeting of the Board of Directors of the Hackensack (N. J.) Gas Light Company, Mr. George W. Conklin was chosen President, vice Mr. E. E. Poor, and Mr. Wallace Dunbar replaces Mr. Frank Poor as Secretary and Treasurer. Mr. D. W. Chamberlain was reappointed Superintendent.

MR. DANIEL T. ROOTS, President of the P. H. & F. M. Roots Company, of Connersville, Ind., writing to the JOURNAL under date of the 17th inst., says: "We have just closed up our last year's business, and are very much gratified indeed at the showing. We find we have made an increase of 56 per cent. in our gas exhanster business for the year '93 over that of '92; our business of '92 being an increase of 25 per cent. over that of '91. Just at this time our business is rather quiet, though we are receiving a large number of inquiries which we feel sure will develop later on. We feel sure that if times pick up as they were during the first six months of '93 we will do the largest business in our history."

AT the annual meeting of the Newburyport (Mass.) Gas and Electric Company the following officers were elected: Directors, E. F. Stone, W. H. Swansey, Eben Sumner, L. B. Cushing, T. C. Simpson, W. E. Johnson, and A. A. Reed; President, E. F. Stone; Clerk and Treasurer, D. D. Tilton; Auditor, W. E. Chase. A semi-annual dividend of 2½ per cent. was declared, which is a reduction of one-half per cent. from the usual rate. The depression in business for the last half of the year is given by the Directors as the cause of the cut.

THE Citizens National Bank, of Lebanon, Ohio, has petitioned the courts for the appointment of a receiver for the Middletown (Ohio) Gas Company.

THE officers chosen by the Cleveland Gas Light and Coke Company are: Directors, David Linton, of Cincinnati, J. H. Morley, W. J. Hayes, F. A. Sterling, D. P. Eells, M. S. Greenough and C. H. Beardslee; President, J. H. Morley; Vice President, M. S. Greenough; Secretary and Treasurer, C. H. Beardslee; Executive Committee, J. H. Morley, D. P. Eells and C. H. Beardslee.

THE Brooklyn Lime Kiln Company's kilns and storage sheds, which adjoin the holder station of the Fulton-Municipal Gas Company, on Bond street, were destroyed by fire on the 17th inst. For a time it looked that the holders were in danger, but the firemen succeeded in saving them.

THE Commissioners of Washington, D. C., have recommended to Congress favorable action on House Bill No. 4,279, which aims at a reduction in gas rates in that city. The Commissioners say: "After due investigation and consideration, the price of $1 per 1,000 cubic feet of illuminating gas furnished to private consumers in the District of Columbia is an equitable compensation to the gas companies."

THE electric lighting companies have suffered a far greater shrinkage in their revenues during the dull times than that experienced by the gas companies.

A REMARKABLE damage suit will shortly occupy the attention of the Washington courts, in which case Michael Rafferty figures as the plaintiff. Raferty is a freight train conductor, and some months ago a train, of which he was in charge, while travelling over the Baltimore and Ohio Railroad, jumped the tracks at Taylorstown and punctured the pipe line of the West Virginia Natural Gas Company. An explosion followed in which Rafferty was badly injured, hence the suit against the Gas Company.

AT the annual meeting of the Middletown (N. Y.) Gas and Electric Light Company, the officers elected were: Directors, Albert Bull, L. C. Purdy, G. T. Townsend, C. Macardell, J. W. Canfield and H. W. Wiggins; President, Albert Bull; Vice-President and General Manager, L. C. Purdy; Secretary, G. T. Townsend; Treasurer, C. Macardell.

JUDGE MCDOUGALL, of Toronto, Canada, on January 19th, delivered judgment in the case of the appeal of the Consumers' Gas Company from the decision of the Court of Revision that its mains and plant should be assessed at over half a million dollars. His Honor dismissed the appeal, in the following summary of reasons: "1. The mains may be well assessed as machinery, forming an indivisible part of its plant, and appurtenant to the lands actually owned by it. 2. The Municipal Act expressly names an easement as a taxable interest, and if the Gas Company's interest in its mains is only an easement, it is expressly assessable. 3. That even if the Municipal Act is not to be read into the Assessment Act, the words 'real property' and 'real estate' now used in Assessment Act cover and include an assessment. 4. That the interest or estate of the Gas Company in the mains and soil in which they are laid is more than an easement; it is a hereditament, and as such, taxable as land. 5. That though laid in the public highways, the mains are not exempt, for the property so conferred is created by Act of Parliament, and in the absence of express words of exemption, its property or estate, like that of other companies, must be taken to be liable to taxation. The exemption of highways and streets from taxation should be strictly construed and confined to the interest of the Crown and municipality therein." The assessment is confirmed as follows:

Lands	$45,750
Buildings and plant, other than mains	217,950
Mains, as part of whole assessment	500,000
Total assessment confirmed	$763,700

The Company admitted to the two first items, but resisted the assessment of the mains.

On December 30th, which date practically marked the retirement of Mr. George S. Hookey from the Superintendency of the Gas Light

Company, of Augusta, Ga., that gentleman was surprised on receiving an invitation to meet several of the employes at the works office on Campbell street. He responded to the call, and was confronted by the spokesman of the delegation, Mr. Henry Allen, foreman of the retort house, who in a very clever speech presented Mr. Hookey with a very handsome walking stick, surmounted by a heavy gold knob. The recipient was completely non-plussed, but eventually managed to stammer an acknowledgment.

In connection with Mr. Hookey's resignation, we publish the following letter, which goes to show the esteem that he was held in by the Company during his official connection with it did not cease when that relation was severed:

Mr. George S. Hookey, Supt., Gas Light Company of Augusta:

My Dear Sir: Your letter of November 1st, addressed to the President and Directors of the Gas Light Company, of Augusta, stating that you had concluded to task a much needed rest, after your long service with the Company as its Superintendent, and tendering your resignation, to take effect on the 15th of January, 1894, has been duly received and by me submitted to a meeting of the Board of Directors. After many expressions of regret, in the discussion which followed the reading of your letter, the following resolutions were passed:

Resolved, That Mr. Hookey's resignation of the office of Superintendent of this Company, to take effect on the 15th January, be accepted.

Resolved, That the President be directed to address Mr. Hookey a letter expressive of our appreciation of his long and faithful service as Superintendent of this Company, of our kind feelings towards him, and of our best wishes for his future health and prosperity.

In the discharge of this duty it affords me pleasure to bear witness, in behalf of the Board and myself, of our high appreciation of the long and faithful services which you have rendered in the office of Superintendent of this Company, and of the deep and abiding interest you have always manifested in its fortunes. In your retirement you will bear with you the warmest friendship of each and every member of the Board, their best wishes for your future good health and prosperity, and the hope that many days of happiness are in store for you, in the enjoyment of a green, old age. In these wishes of the Board I fervently join, and tender you now, in addition to what the Board has said, my own personal high appreciation of your past services, my earnest desire that every earthly blessing will attend your future, and that your last days may prove the happiest and best.

Very truly yours, Geo. T. Barnes,
President of The Gas Light Company, of Augusta.

The new mill of the Diamond Mills Paper Company, at Milbank, N. J., is being put in place by the Berlin Iron Bridge Company, of East Berlin, Conn.

The annual meeting of the People's Gas Light Company, of Cleveland, O., resulted as follows: Directors, Messrs. George H. Warmington, M. A. Hanna, R. R. Rhodes, Charles McNeil and Belden Seymour; President, George H. Warmington; Secretary, J. M. Carrington; Superintendent and Engineer, D. R. Warmington.

The Philadelphia Nationalist Club is greatly interested in the project for the establishing of a municipal electric plant in that city, as witness the following argument that they put forth on behalf of the scheme: "The city of Philadelphia (a corporation of which each citizen is a member and stockholder) could very advantageously establish a complete electric plant for its own purposes. From this plant it could light all streets and public buildings at a far less cost than the city now pays to private companies for the same service. The experience of other cities amply proves this fact. It could also furnish electric lighting for all private parties desiring it for mercantile and manufacturing establishments and dwellings at a comparatively small cost and yet with a moderate profit. In addition to this it could furnish electric power for light manufacturing purposes at a low cost, and thus make Philadelphia an especially desirable location for those desiring to carry on such industries. Still further, it could, at a practical price, supply electric power for the purpose of running sewing machines and for other domestic uses, the present high prices being practically prohibitive of its use for such purposes. Such an electrical department should be established in the beginning on soundest business principles and with such well-defined rules of service as to keep it forever out of the domain of corrupt party politics. That is, it should be conducted by electrical engineers of the highest scientific skill and workmen of practical ability, whose qualifications should be ascertained by the most careful investigation and practical examination; all appointments, after the department is thoroughly established, should be only to the lower ranks, and all higher positions filled by promotion of those making the best records; no employee should be dismissed except for sufficient cause, to determine which he should have the right to demand a fair trial. Thus we should get a service that would keep constantly abreast of the times in electrical progress."

Some of the daily prints in San Francisco having asserted that the burners in the street gas lamps of that city were consuming only 3 feet per hour instead of the 5 feet called for in the contract, President Crockett, of the San Francisco Company, personally appeared before the Board of Supervisors and made the following statement: "Some very serious charges have been brought against the San Francisco Gas Light Company in a morning paper, and the Company not only courts but demands the most rigid investigation. The charge is made that the Company has changed the burners lately, using 3 foot instead of 5 foot tips. It is true a change was made. It has been some years since the tips were changed, and we found that they had become old and useless. I can prove that they were consuming all the way from 6 to 8 feet an hour, while our contract called for 5 feet. To remedy this defect, which was a loss to the Company, we sent East for the most improved burners made. Every burner tip that we have put on has been accurately tested, and we defy anyone to prove that they burn less than 5 feet an hour."

The Citizen's Gas Company, of Brooklyn, N. Y., has placed the order for an iron roof for its new producer house with the Berlin Iron Bridge Company, of East Berlin, Conn. The building is 69 feet in width and 151 feet in length, and the roof is to be of iron covered with slate.

The Regulation of Foreign Petroleum Supplies.

Engineering says that the Russian petroleum producers have, at a recent meeting at St. Petersburg, agreed upon the following arrangement: The export of petroleum and its sale on the foreign markets shall be left to a committee of five members, of which three were elected at the meeting, viz., the Caspian Company, the firm of Schibajeff, and the manufacturer Unanoff; the other two will be elected at Baku. In addition to these five, the union elect a number of selling or commercial agents. For export of petroleum without the knowledge of the committee, the manufacturer has to pay a fine. The part of every member in the transactions is fixed by shares, which are again based upon each 1,000 poods of petroleum actually exported during 1892 from Baku via the Transcaspian Railway. The quantity of petroleum which, according to this scale, will be fixed for each producer to supply, is handed over to the committee of five, who sell it for account of the union. The manufacturer who does not deliver the stipulated quantity is bound to make good the loss arising from such deficiency, unless it is caused by fire or other accident. The commercial agents are under the control of the committee, to whom they have to produce monthly accounts of their dealings. The five members of the committee do not receive any remuneration for their work; they are the honorary representatives of the union.

In order to make this arrangement definite, it is required that representatives for at least 80 per cent. of Russia's export of petroleum join the union—so far, 60 per cent. have joined. Negotiations are at the same time progressing between the Russian petroleum exporters and the American Standard Oil Company about dividing the world's market between them in the following manner: The Standard Oil Company should supply 70 per cent., and Russia the remaining 30 per cent. of the requirements of the importing countries. Whilst the Standard Trust and the Russian producers are thus endeavoring to compromise matters, the American concern is competing more keenly than ever against the Crescent pipe line, which, especially in France, has proved a thorn in the flesh of the Standard Oil Company. This latter company now intends to undersell the former in France, and has built a store at Rouen capable of handling 600,000 barrels per annum. Sites have further been bought for similar installations at Marseilles, Cette, Bordeaux, and Havre. A large depot has been erected in Paris, which is being supplied from Rouen. The Standard Oil Company is thus endeavoring to gain the same footing in France as it already holds in Germany through the German-American Petroleum Company, in England through the Anglo-American Oil Company, in Holland and Belgium through the American Petroleum Company, in the Scandinavian countries through the Danish Petroleum Company, and in Italy through the Italian-American Petroleum Company.

The Market for Gas Securities.

Consolidated is dull and weak, the opening price to day (Friday) being returned at 124 to 125. Yesterday 720 shares Consolidated were sold on the Exchange at 125 to 124½, and it was offered at the close at 124⅝. We know of no reason for the depression. Other city shares show no change.

The Brooklyn situation is still in the same chaotic condition, but the Addicks interest seems to be slowly gaining the upper hand. Quotations, which are merely nominal anyway, are virtually the same as those given at last time of writing. Chicago gas keeps firm; the opening to-day was made at 66½ to 66⅝. Bay State is stronger, at 16 to 17, as is also Baltimore Consolidated, at 55½ to 55¾. At auction: 200 shares Peoples, of Brooklyn, at 80, and 100 shares Equitable, New York City, at 182. In our last issue we reported the sale at auction of 35 shares Central, of New York City, at 75, which was an error, in that the sales figure was 100.

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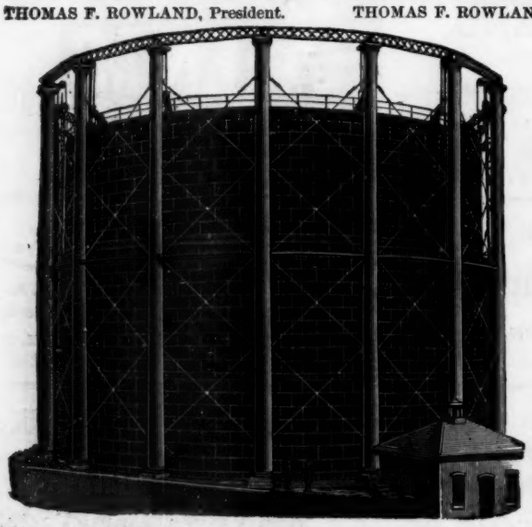

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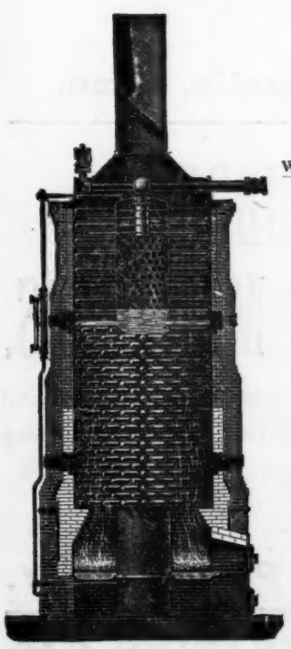

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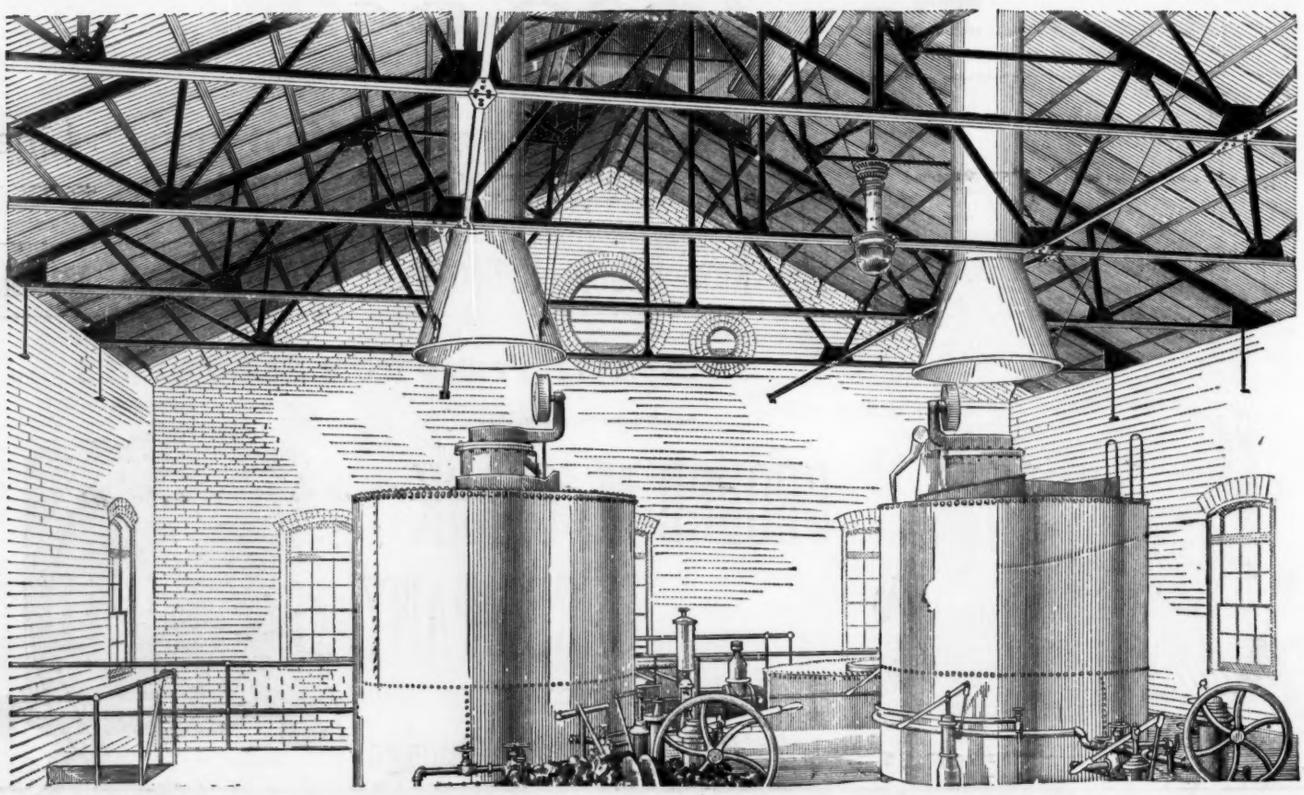

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Providence Gas Light Company, at Providence, R. I. The building is 40 ft. in width by 100 ft. in length, the side walls being of brick and the roof being entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The building is ventilated by our Improved Ventilator, extending the full length of the roof, with side shutters opened and closed by cords from the floor. No woodwork is used in any way about the construction of the building.

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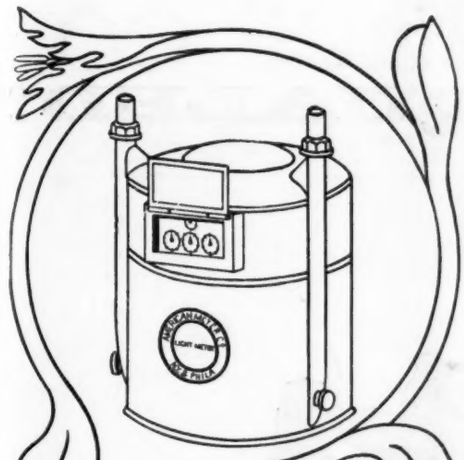

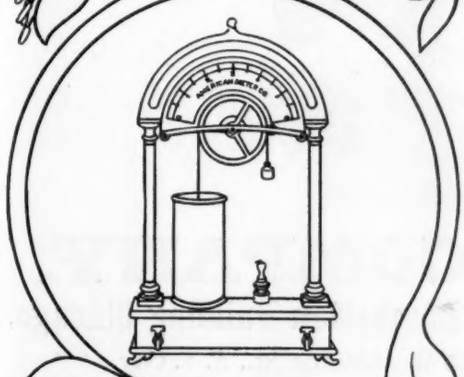

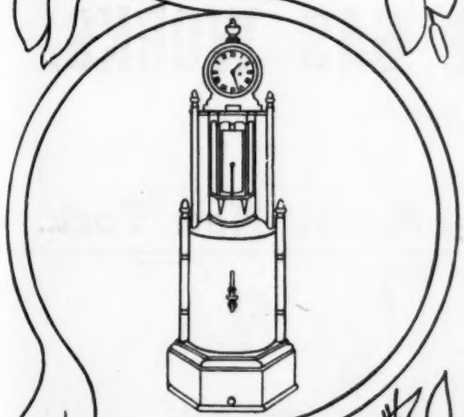

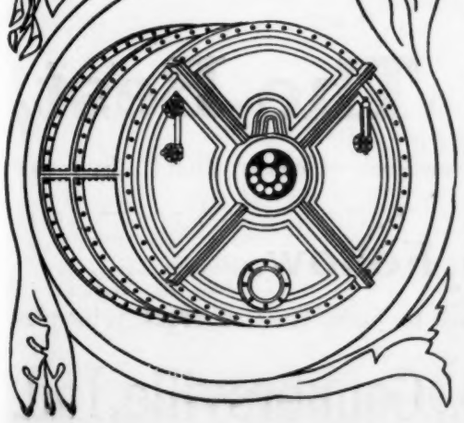

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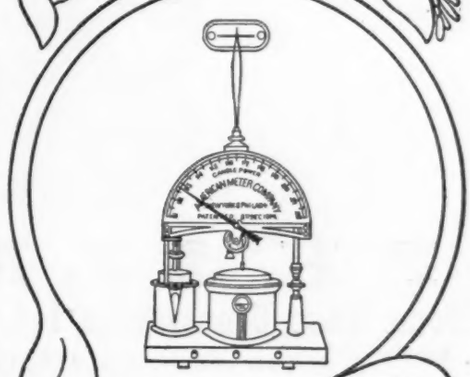
PUBLIC LIGHTING TABLE.

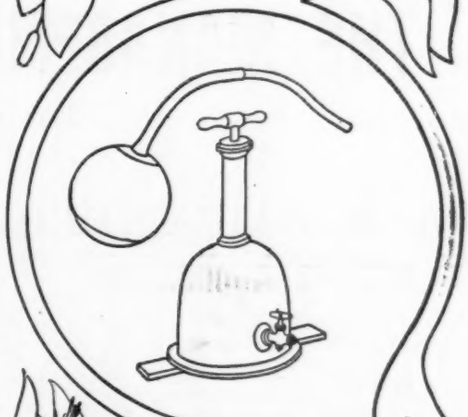
FEBRUARY, 1894.

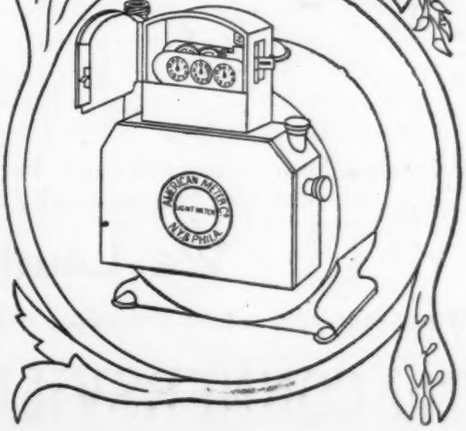
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Thu.	1	5.50 PM	6.10 AM	5.05	6.15
Fri.	2	5.50	6.10	5.05	6.15
Sat.	3	5.50	6.10	5.05	6.15
Sun.	4	5.50	6.10	5.05	6.15
Mon.	5	5.50 NM	6.10	5.10	6.10
Tue.	6	5.50	6.00	5.10	6.10
Wed.	7	6.00	6.00	5.10	6.10
Thu.	8	6.00	6.00	5.10	6.10
Fri.	9	6.00	6.00	5.10	6.10
Sat.	10	9.40	6.00	5.10	6.10
Sun.	11	10.40	6.00	5.10	6.10
Mon.	12	12.00	6.00	5.20	5.55
Tue.	13	1.10 AM FQ	6.00	5.20	5.55
Wed.	14	2.20	5.50	5.20	5.55
Thu.	15	3.30	5.50	5.20	5.55
Fri.	16	4.30	5.50	5.20	5.55
Sat.	17	No L.	No L.	5.20	5.55
Sun.	18	No L.	No L.	5.20	5.55
Mon.	19	No L. FM	No L.	5.30	5.55
Tue.	20	6.10 PM	7.30 PM	5.30	5.55
Wed.	21	6.10	8.40	5.30	5.55
Thu.	22	6.10	9.50	5.30	5.55
Fri.	23	6.10	11.00	5.30	5.55
Sat.	24	6.20	12.10 AM	5.30	5.55
Sun.	25	6.20	1.10	5.30	5.55
Mon.	26	6.20	2.20	5.30	5.45
Tue.	27	6.20 LQ	3.20	5.30	5.45
Wed.	28	6.20	4.10	5.30	5.45

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45







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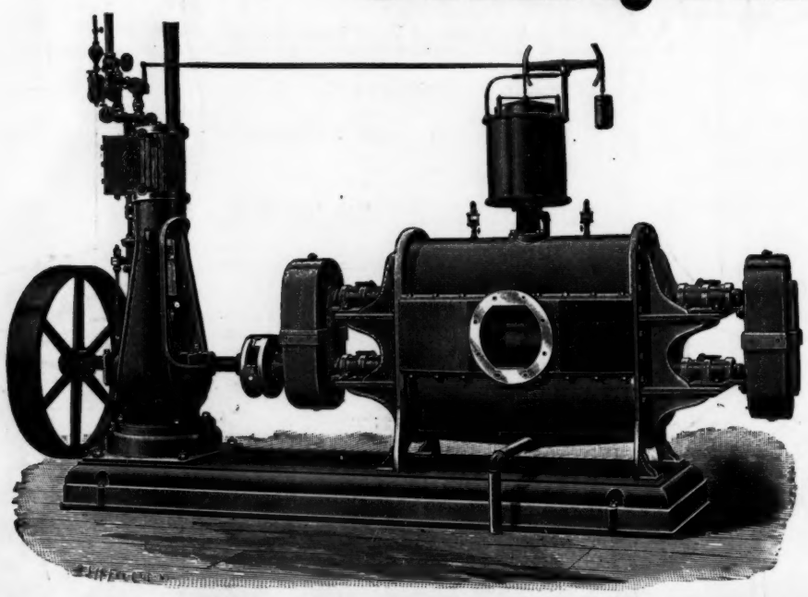

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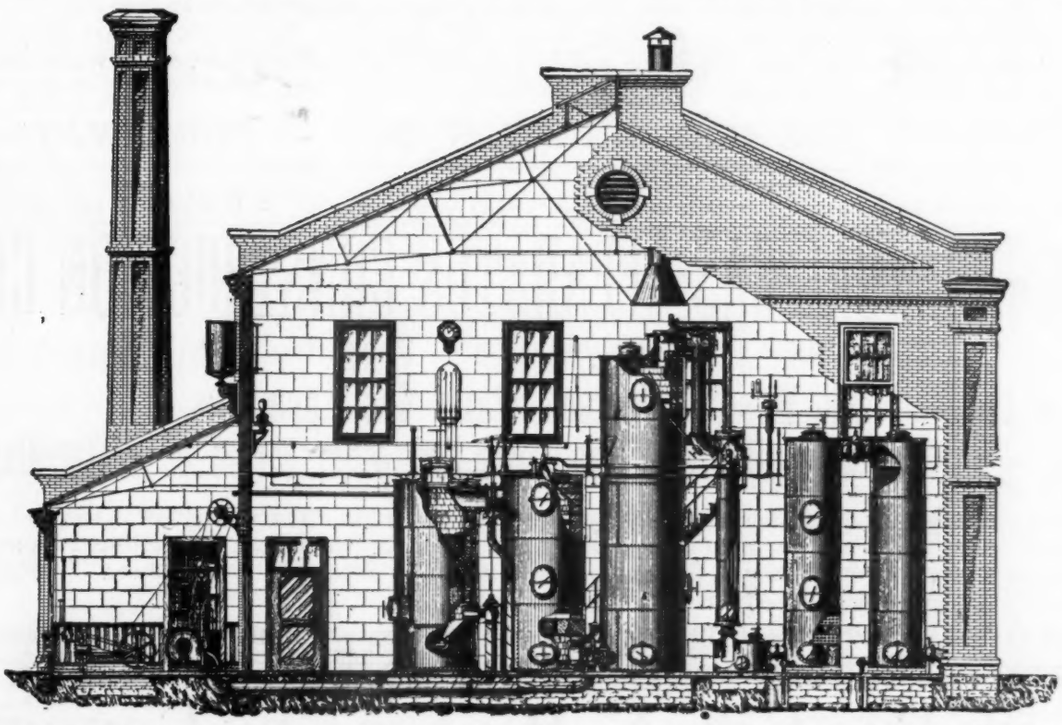

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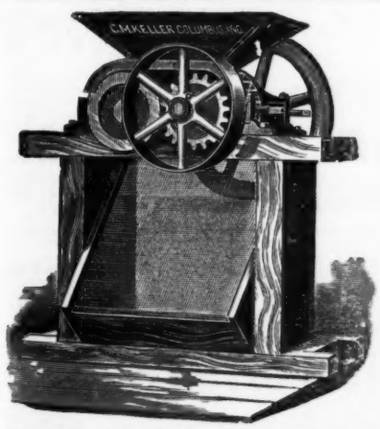

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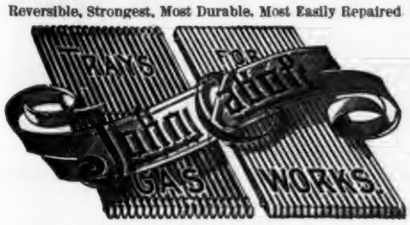

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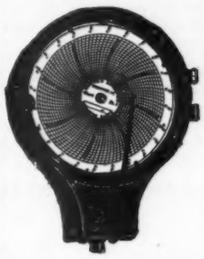

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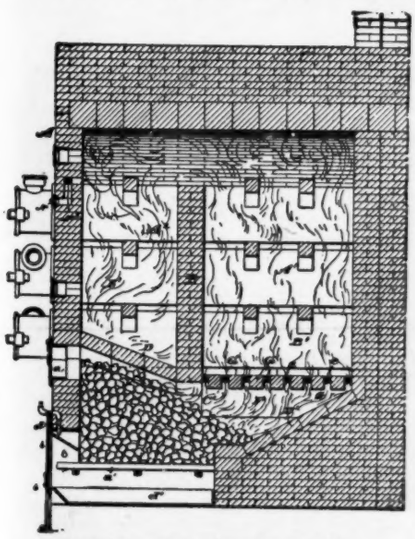

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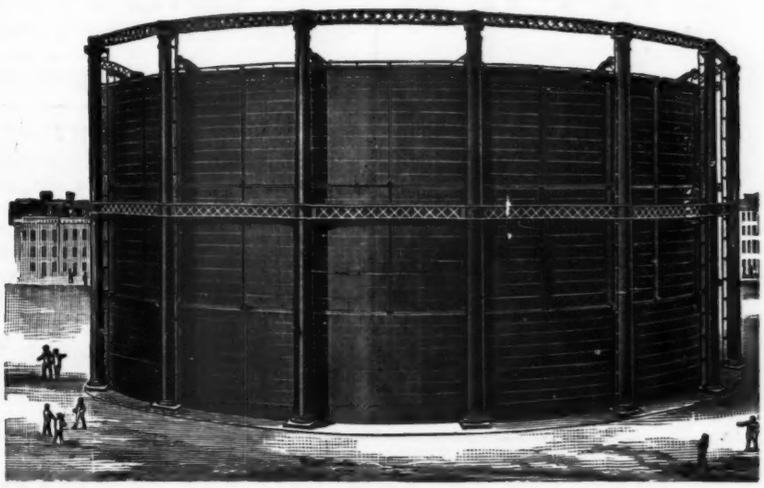

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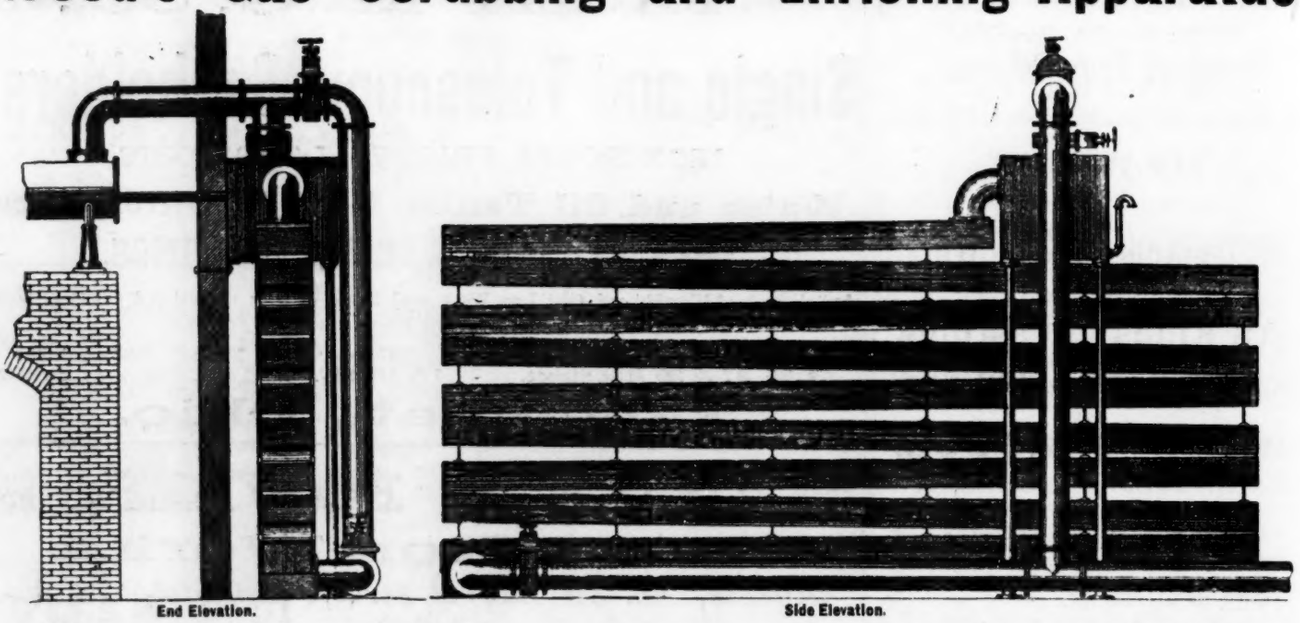

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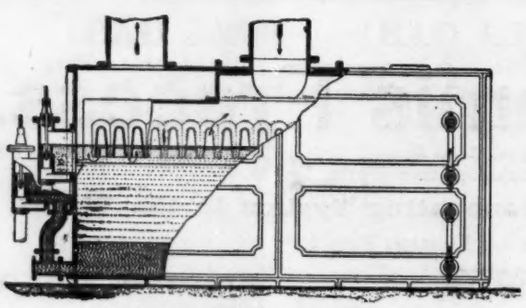

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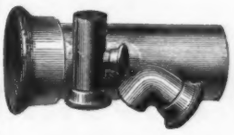

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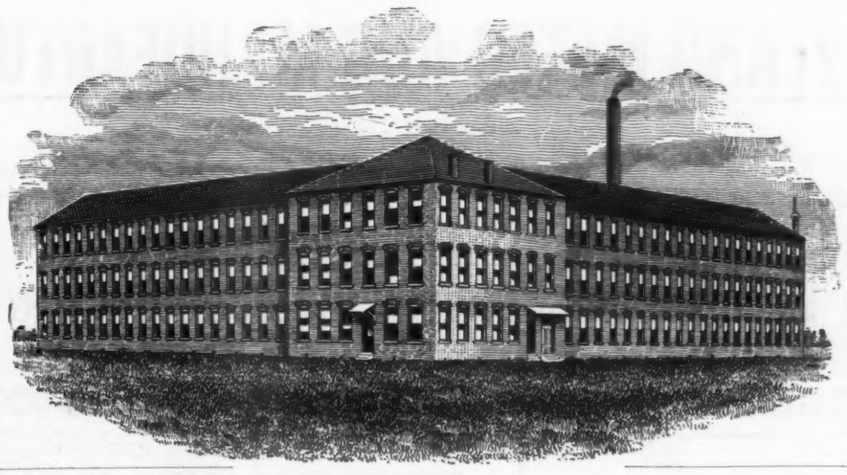

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